ADVANCED COMMUNICATIONS TECHNOLOGY

Eighth District BOATRACS Test and Evaluation Final Report

Prepared for:

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Systems Directorate

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Executive Summary

One of the objectives of the Mobile Communications Infrastructure project is to conduct in-depth evaluations of mobile satellite systems that appear to meet Coast Guard communications requirements. The goal in testing these systems is to quantify how well they work and to provide some metrics to see how each of these systems could fit the needs of the Coast Guard. There are a variety of parameters that will be measured for each system. Most of the measurements are of the overall system, not the individual pieces. These parameters include coverage, availability, reliability, accuracy, interoperability, bandwidth, latency, ease of use, and cost. Some testing will be performed in the Advanced Communications Lab at the R&D Center, and some will be performed by placing systems on operational units for field testing.

The Eight Coast Guard District has an extremely large AOR encompassing 26 States. The District is responsible for 1,200 miles of coastline and 10,300 miles of inland waterways. The major missions are Law Enforcement, Search and Rescue, and Pollution Response. To meet the mission needs in this large AOR, the District has numerous cutters and boats. Currently, the District Command Center does not maintain an up-to-date surface picture so the ability to receive near real-time position reports from all assets would be highly beneficial. In addition, the District lacks the ability to communicate with all vessels at all times.

The purpose of this effort was to test and evaluate the BOATRACS system to determine whether the BOATRACS system specifically, and satellite data communications system in general, can be effectively used to solve the communications problems in the Eighth District. Specific evaluation criteria are defined in section 3.1 below. In general, the questions to be answered are: does a system such as this, improve performance, meet requirements not currently being met, and/or reduce cost.

The system was installed on several vessel types: WPB, UTB and 19 ft RHIB. The system was then used by these units for about 6 months. Messages are sent and received fairly quickly, taking from 1 to 8 minutes depending upon the mode of operation. This is acceptable for routine, operational, and administrative messages. It might not be sufficiently timely for emergency messages however. Coverage was very good. As expected, there was no location in the AOR that did not have coverage. This was the biggest asset of the system to the users: they knew that they would always have communications coverage, even when all other systems were unavailable. The system also turned out to be much cheaper than cellular.

Many users were new to using data systems and were used to using voice for all communications. That is still the mode preferred for many functions. However, there were many cases where the data capability was very useful such as for EPIC checks, boarding reports, and termination cases; anything where a lot of information needed to be communicated accurately. With more operational guidance and procedures in place, a system such as this could be used much more advantageously. However, for these classes of vessels, the system needs to be kept simple and easy to use. That was one of the advantages of the BOATRACS system.

In conclusion, a data system such as this can add a valuable capability to units of these classes. In addition, in this AOR with the severe communications deficiencies, it provides, in many cases, the **only** communications capability. It is not a replacement for traditional voice communications, but an enhancement. There are many functions that can be done more easily and more quickly with a data system; however, some things are still best done using voice circuits. For units that are supplementing CG VHF frequencies with cellular phones, this offers a cheaper alternative.

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1. INTRODUCTION

One of the objectives of the Mobile Communications Infrastructure project is to conduct in-depth evaluations of mobile satellite systems that appear to meet Coast Guard communications requirements. The goal in testing these systems is to quantify how well they work and to provide some metrics to see how each of these systems could fit the needs of the Coast Guard. There are a variety of parameters we will measure for each system. Most of the measurements will be of the overall system, not the individual pieces. These will include coverage, availability, reliability, accuracy, interoperability, bandwidth, latency, ease of use, and cost. Some testing will be performed in the Advanced Communications Lab at the R&D Center, and some will be performed by placing systems on operational units for field testing.

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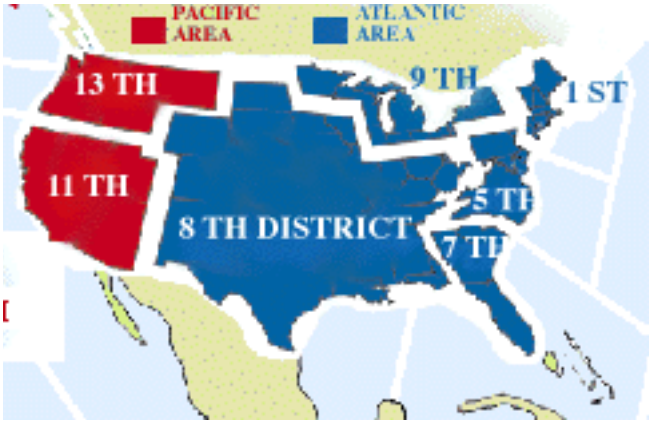

To meet the mission needs in this large AOR, the District has numerous cutters and boats. Currently, the District Command Center does not maintain an up-to-date surface picture; the ability to receive near real-time position reports from all assets would be highly beneficial. In addition, the District lacks the ability to communicate with all vessels at all times.

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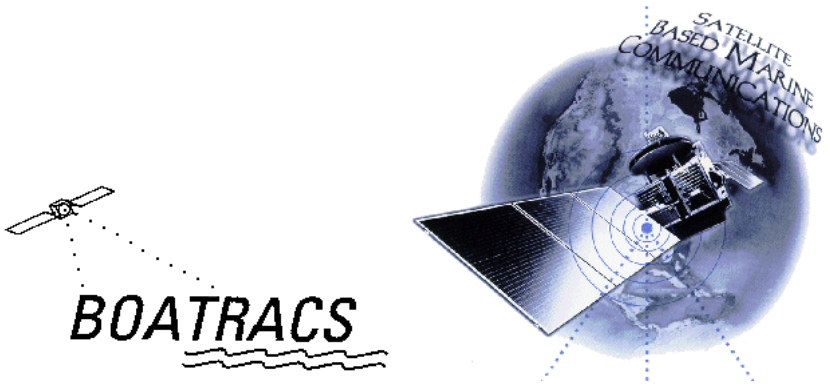
2. BOATRACS SYSTEM[1]



"Headquartered in San Diego, CA, BOATRACS Inc. provides two-way satellite-based messaging and vessel tracking services for the commercial marine market, including the workboat, inland and coastal towing, oil supply and fishing industries."[2] BOATRACS is the maritime distributor for QUALCOMM's OmniTRACS service. Most of the system is the same as for OmniTRACS, so the references that describe the OmniTRACS system also apply to BOATRACS. BOATRACS however, operates their own message center, and provides many enhanced services that are not available to OmniTRACS users. They market themselves as a total solution provider: hardware, software, and service.

BOATRACS provides two-way data transmission and position location (to within 300 m using triangulation) within the coverage footprint of the Continental United States (CONUS) and 200–400 miles offshore. The user terminals are in continuous contact with the geostationary satellite, which relays messages between the ship and the earth station. Messages are accessed from and sent to the earth station via a variety of terrestrial links. Figure 2-1 illustrates the system concept.

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[1] Most of this section is from the Advanced Communications report: "Technical Assessment of Mobile Satellite System Alternatives," April 1998.

[2] BOATRACS Web Site, http://www.boatracs.com/.

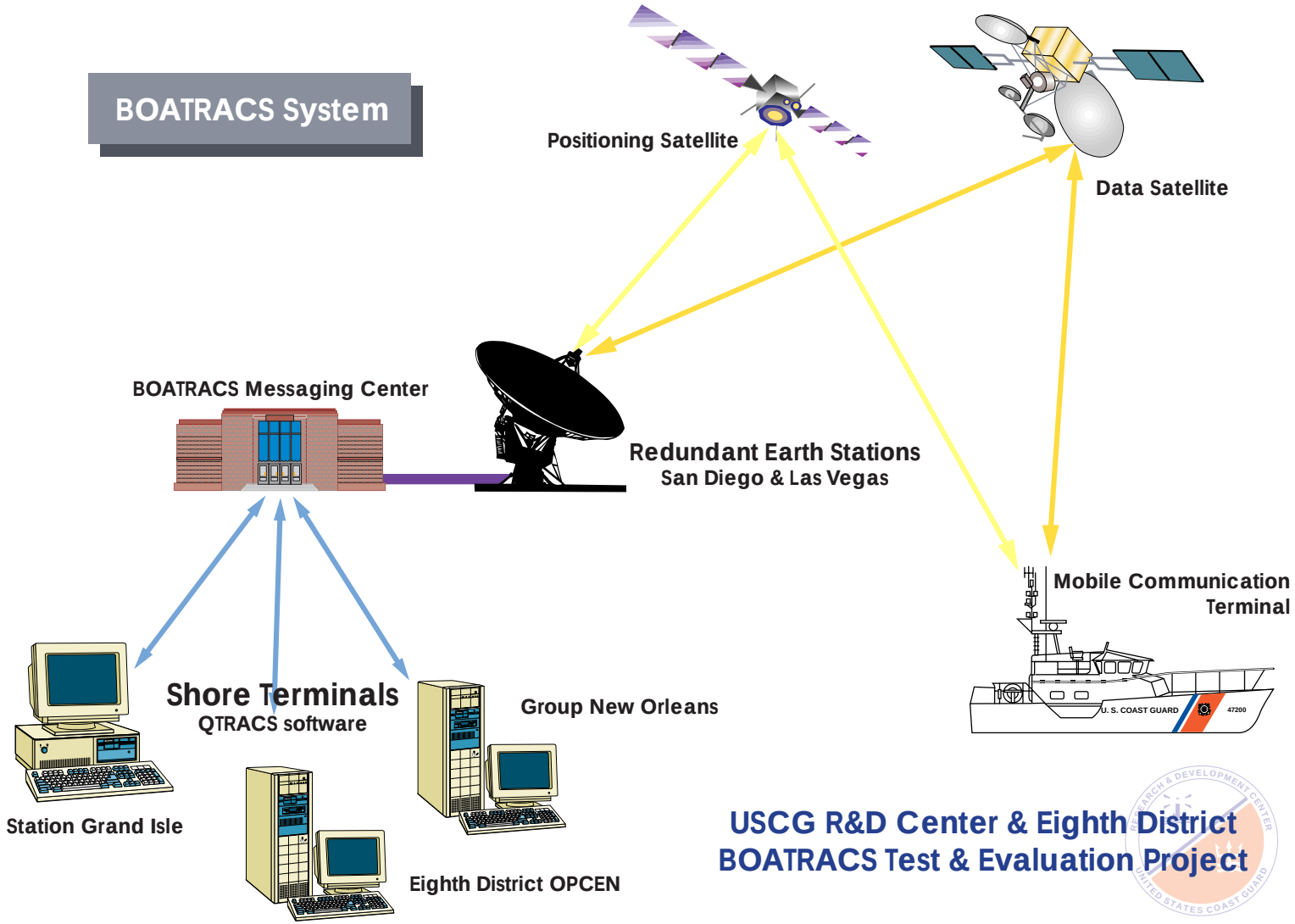

Figure 2-1 — BOATRACS System Diagram

2.1 GROUND SEGMENT

QUALCOMM operates two redundant earth stations; the primary in San Diego, CA and the backup in Las Vegas, NV. The Network Control Center and the BOATRACS message center are both in San Diego. Outgoing messages to user terminals are sent as soon as received at the earth station. Incoming messages are kept in a mailbox until the shore terminal connects to the earth station and downloads them. There are also provisions at the BOATRACS message center to route messages via facsimile or the Internet.

2.2 SPACE SEGMENT

QUALCOMM leases Ku-band transponders (currently seven) on existing satellites. Currently service is provided on the G-Star GE-1 satellite. A second satellite is used for the positioning service. Both satellites receive each transmission, and a position is calculated at the earth station from the transmitted signal using a triangulation algorithm. The geostationary satellite provides coverage throughout CONUS and offshore 200–400 miles. Additional coverage is provided in Europe using transponders leased from EUTELSAT.

2.3 USER SEGMENT

The Mobile Communications Terminal (MCT) consists of three parts: a ruggedized keyboard display unit, a communications unit, and a continuous tracking antenna. The communications unit is capable of transmitting position reports without a keyboard display unit. The keyboard display is used to send and receive text messages. The system also supports the use of macros (templates) to reduce the amount of data being transmitted. BOATRACS also provides software to enable a generic personal computer to interface with the communications unit, which provides the capability to send/receive files.

All communications between the MCT and the earth station are at Ku-band. The system has some inherent “security” features in that it uses a combination of TDMA and CDMA for multiple access and Direct Sequence Spread Spectrum modulation.

2.4 MARKET

OmniTRACS currently has approximately 185,000 units in active service, primarily installed on tractor-trailer trucks. Their primary market is fleet management (messaging and tracking). BOATRACS has a similar market, but within the maritime community. BOATRACS currently has approximately 3,000 units installed on fishing vessels, tugs, and resupply vessels.

2.5 BOATRACS TERMINAL

BOATRACS data communications operates in a closed loop environment so that the users know that delivery status of each message. Each message is positively acknowledged. Built into the basic structure of the QUALCOMM OmniTRACS system is position updates every hour with no crew activities required. Position updates are also provided with each message.

BOATRACS can operate in a several configurations (see Figures 2-2 and 2-3). The basic vessel hardware utilizes a display unit with a keyboard. BOATRACS also can integrate with onboard PCs thereby giving the crew access to any application necessary. This capability enables the vessel to be integrated into the office as though it was another office down the hall.

Figure 2-2 — BOATRACS Mobile Communications Terminal (MCT)

Figure 2-3 — BOATRACS Enhanced Display Unit

Unlike other forms of marine communications such as cell phones and radios, BOATRACS communication is secure to eavesdroppers. The data is frequency hopped to and from the satellite thereby making it jam resistant. The data transported on the phone lines is password and account protected. If required, encryption devices may also be installed.

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3. SYSTEM TESTING

The BOATRACS system was tested both in the Advanced Communications Lab (a.k.a. the Comms Lab) and in the field (on CG cutters and boats in the Eighth District).

3.1 MEASUREMENT PARAMETERS

The specific parameters the system was measured against are described in the following paragraphs. They are divided into two categories: Technical Performance and Operational Performance.

3.1.1 System Technical Performance

These parameters address the performance of the system itself, and are generally things that can be quantitatively measured.

3.1.1.1 Coverage

Coverage is the geographic area in which a mobile user has access to the satellite system. For the BOATRACS system we needed to assess whether the system provides coverage throughout the Eighth District AOR. This was done by keeping a record of all positions transmitted, and then analyzing the data with MapInfo. Also, users were asked to document any areas where unable to transmit or receive and indicate sea state and whether there were any blockages to the line of sight to the satellite (SSW).

3.1.1.2 Accuracy

Position accuracy was assessed to determine how accurate and dependable was the calculated position information as compared to DGPS. This was determined through post-analysis of position information, and comparison to a known (DGPS) position.

3.1.1.3 Availability

Availability is the amount of unit time on any given day that the system is available for use. Reasons for non-availability could include: the traffic exceeds the capacity of the system, the system is temporarily out of service, or a satellite is not in view. Failure of user equipment would not be a reason for system non-availability (that would be addressed under reliability). Users were asked to keep track of this in a trouble log, especially to keep note of whether the system performed in all weather conditions.

3.1.1.4 Cost Metrics

This parameter addresses the costs associated with the system. This includes equipment costs and recurring service fees. Recurring service fees would be the monthly access fees, and a usage fee based on airtime or the amount of data sent. This data was compiled based upon inputs from the system and service providers. These costs were compared to the cost of doing business by other means (cellular, HF, etc.).

3.1.1.5 Interoperability

Interoperability is a measure of how well the system interfaces or integrates with existing systems. Some questions to be answered included:

- How would we integrate it with existing Coast Guard systems?
- How well does the system integrate with other CG systems?
- How would we use it?

3.1.1.6 Latency

Latency is the end-to-end delay in the system. In a data transmission, this metric can be just as important as speed or bandwidth of the channel. It is affected by a variety of things. The first and most obvious would be the length of the path. Other parts of the delay would be due to other factors i.e., the earth station, buffering, system loading, and congestion. This was measured by testing in the Comms Lab.

3.1.1.7 Reliability

Reliability is a measure of a system's dependability. This was evaluated both in the lab and the field by monitoring and recording equipment failures. Users were asked to track all equipment failures, and time to repair in the trouble log.

3.1.2 System Operational Performance

These metrics generally address how well the system helps the Coast Guard perform its missions. They are generally qualitative in nature and based upon feedback from the users in the field. The goal was to capture specific examples from the field and identify time or money savings, and any performance enhancements.

3.1.2.1 Data communications

How valuable was the ability to have data communications with these assets.

3.1.2.2 Real-time vessel locations

How valuable was the ability to have a real-time location on these units?

3.1.2.3 Protected Communications

How valuable was are protected communications to the unit?

3.1.3 Ease of use

How easy was the system to use? How much training was required? How long did it take to become proficient in using? This will be evaluated by lab and field tests.

3.1.4 Efficiency improvements

Was there any improvement to operational efficiency?

3.2 FIELD TESTING

MCTs were installed on several cutters and boats for this test and evaluation (listed below). Photographs of the units and the location of the BOATRACS equipment onboard each unit are provided.

- Two 82 ft Patrol Boats (WPB), the *USCGC Point Sal* (Figures 3-1 thru 3-3) and the *USCGC Point Winslow* (Figures 3-4 and 3-5).
- Two 41 ft Utility Boats (UTB), 41346 and 42426 (Figures 3-6 thru 3-9).
- One 19 ft Rigid Hull Inflatable Boat (RHIB), 193513 (Figures 3-10 thru 3-12).

Figure 3-1 USCGC Point Sal, Grand Isle, LA.

Figure 3-2 USCGC Point Sal, standing on dock looking at Port side and mast. Note the BOATRACS antenna (small dome) mounted below and to the right of the RADAR antenna (outlined in white).

Figure 3-3 Point Sal, inside of pilothouse looking forward. Note the BOATRACS Enhanced Keyboard Display Unit mounted on the console to the left of the RADAR screen (outlined in white).

Figure 3-4 USCGC Point Winslow, standing on bow looking aft. BOATRACS Antenna is mounted on a standoff on the Port side of the Pilot House roof (outlined in yellow)

Figure 3-5 USCGC Winslow, inside of Pilot House looking aft. Note the BOATRACS Enhanced KDU mounted on the aft bulkhead of the Pilot House (outlined in yellow).

Figure 3-6 USCG Station Grand Isle, LA. Boathouse with CG 41346 and CG 41426.

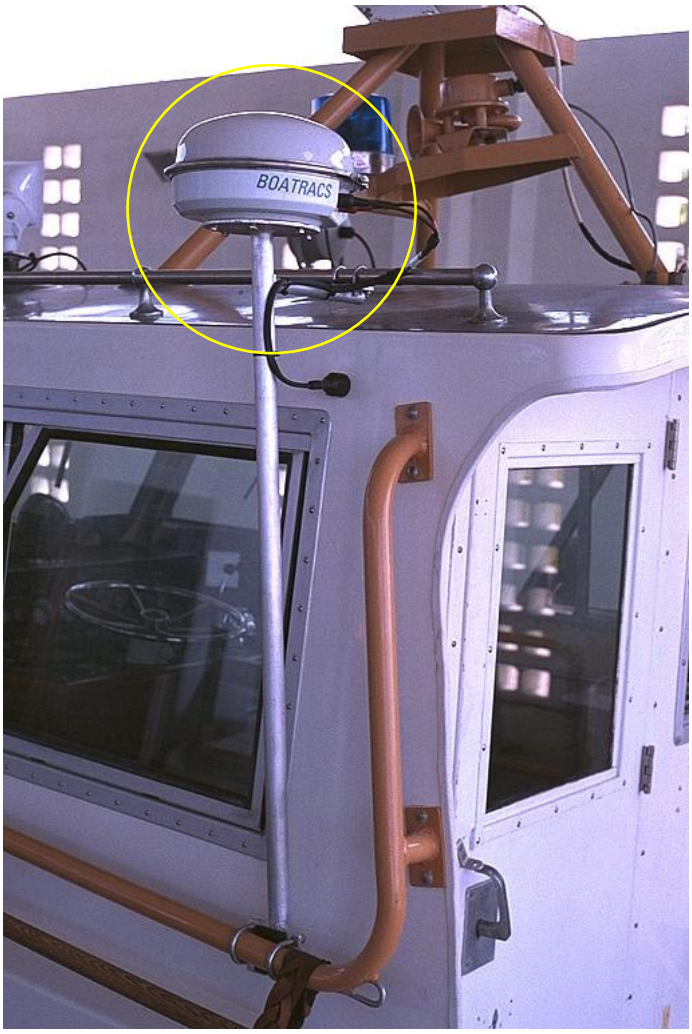


Figure 3-7 41 ft UTB, standing on dock looking at Port side. The installations on both 41426 and 41346 were identical. Note the BOATRACS antenna mounted on a standoff that is bolted to the rail on the Port side of the cabin (outlined in yellow).

Figure 3-8 41 ft UTB, inside cabin, looking to Starboard and aft. The BOATRACS Enhanced KDU was initially mounted on the side of the chart table, located on the Starboard side of the cabin (outlined in white).

Figure 3-9 41 ft UTB, inside lower cabin looking at Port side. After the 41's were renovated and the cabin rearranged to the new standard, the Enhanced KDU was moved to the counter in the lower cabin, Port side. This location was not as easily accessible to the crew as the initial location.

Figure 3-10 19 ft RHIB, CG 193513, USCG Station New Orleans, LA. This boat is trailered to the desired location and then put into the water.

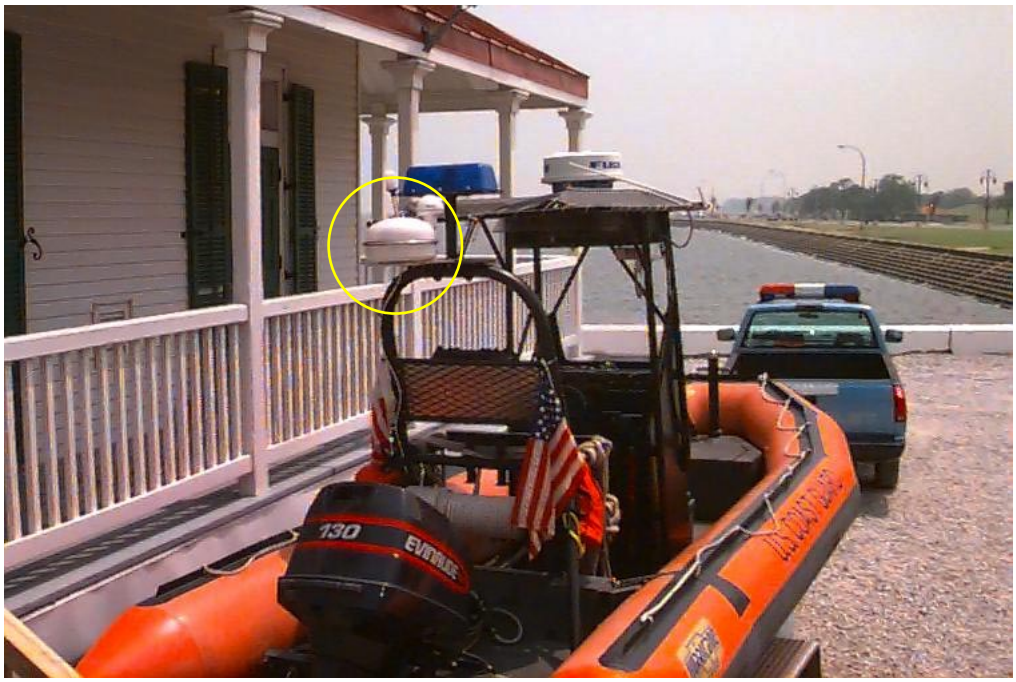


Figure 3-11 19 ft RHIB looking forward from stern. Note the BOATRACS antenna mounted on a plate behind the Blue Light (outlined in yellow).

Figure 3-12 19 ft RHIB, looking aft from cox'n's station. Note the BOATRACS Enhanced KDU mounted inside of a Pelican case on the front side of the rollbar.

4. SYSTEM PERFORMANCE

4.1 NETWORKING PERFORMANCE

Typically a number of tests are conducted in the Advanced Communications Lab at the R&D Center. Since this was a data-only e-mail type system, voice testing and data channel testing could not be done. Testing was only done at the Network layer. Also, due to the type of system (data-only, small packets, e-mail type system) throughput could not be measured. Using the test bed described below, the latency in the system was evaluated.

4.1.1 Test Bed

To test the BOATRACS performance a testbed was set up in the Advanced Communications Lab. This is illustrated in Figure 4-1. The Enhanced Keyboard Display Unit (KDU) was connected to the MCT to test the standard messaging function. It was used to send and receive messages from the "mobile" side. A computer running the QTRACS software was used on the "shore" side of the system to send and receive messages to/from the MCT. The QTRACS software used a modem to dial the Earth Station over the PSTN and send/receive messages. This information path is colored blue in the diagram below.

The e-mail connectivity was also tested. For this testing, a laptop running the WBUI software was connected to the MCT. This was used to send/receive Internet e-mail. On the "shore" side a computer using off-the-shelf POP3 mail software (Eudora Pro) was used to send and receive Internet e-mail. The e-mail client software connected to a local server running POP3/SMTP mail server software (Eudora Internet Mail Server) which was connected to the Internet via the R&D Center Internet connection. The use of the mail server on the local LAN allowed more accurate timing measurements to be made. This information path is indicated in red in the diagram below.

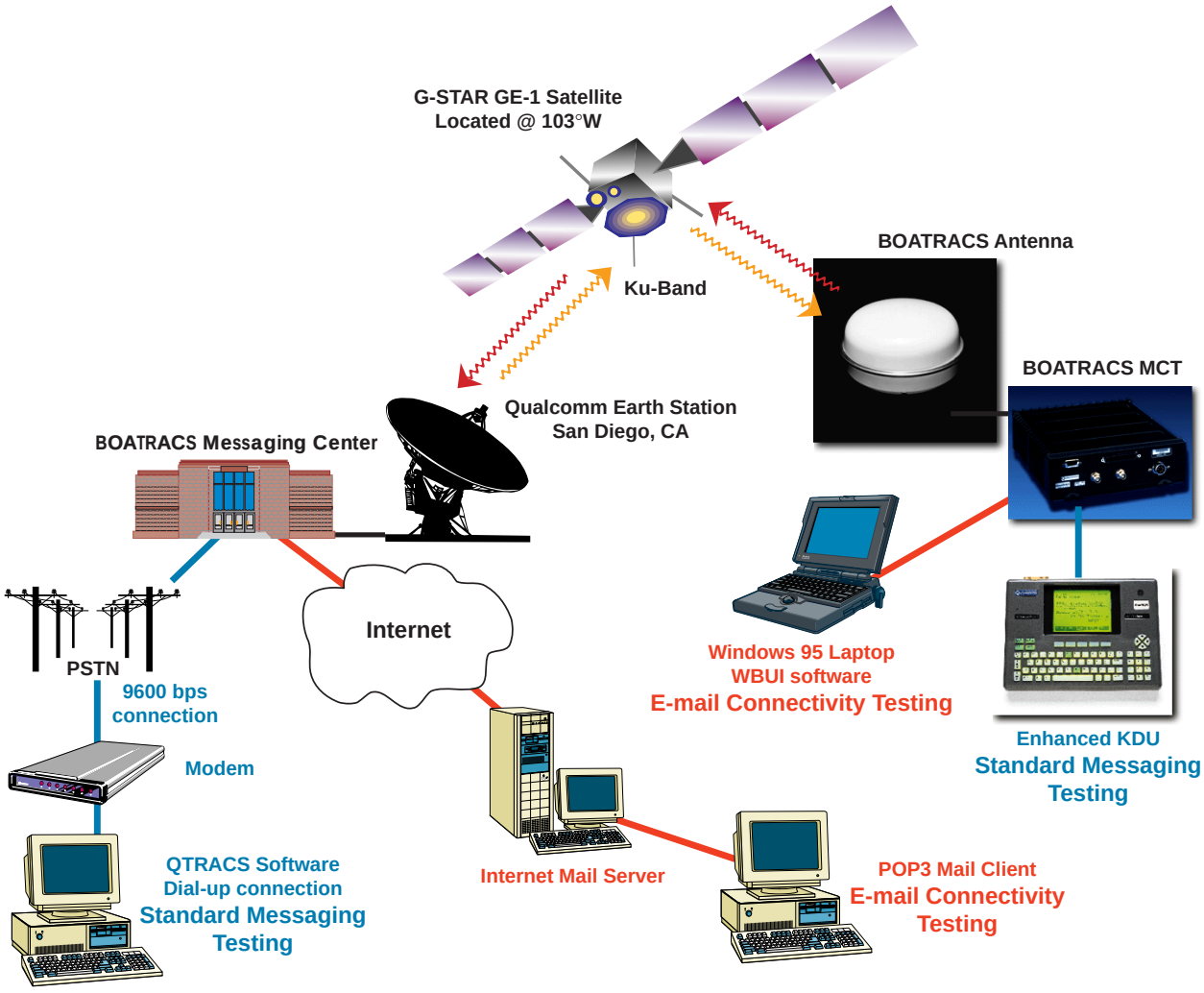


Figure 4-1 BOATRACS Network Performance Testing Diagram

4.1.2 Latency

The system latency (how long it takes for a message to get from origin to destination) was measured in the lab. Latency was measured for both e-mail and standard message modes. E-mail is using the BOATRACS Internet e-mail gateway. Standard messages are transmitted and received on the shore side using the QTRACS software.

The results are summarized in Table 4-1. The Queue Time is how long the message sat at the terminal waiting to be transmitted. The Transit Time is how long for the message to be transmitted and delivered. The Total Time is the sum of the two. The Forward direction is from shore to the mobile terminal (MCT). The Return direction is from the MCT to shore.

Table 4-1 Message and e-mail transfer results. All times are averages. Complete data is in Appendix B-1

Mode	Queue Time	Transit Time	Total Time
Forward Message	<1 min	< 1 min	< 1 min
Return Message	2.4 min	2.2 min	4.6 min
Forward E-mail	< 1 min	5.9 min	6 min
Return E-mail	1.3 min	6.13 min	7.43 min

4.2 COVERAGE

Coverage is the geographic area in which a mobile user has access to the satellite system Coverage was reported by the users to be good throughout the AOR. On the VHF side, poor (i.e. none) communications were reported in the Western part of the AOR. There were many reports from the users of circumstances where BOATRACS was the only communications method available—both cellular and VHF-FM were unavailable.

The pictures below show all of the BOATRACS position reports received to date. Each unit icon is a different color. The numbers of reports for each vessel are listed below.

Unit Name	**Icon Color**	**Number of POSREPS**
Pt Winslow	Blue – Figure 4-2	4,079
Pt Sal	Red – Figure 4-2	1,341
GI 41426	Blue– Figure 4-3	187
GI 41346	Red– Figure 4-3	362
NO 193513	Green– Figure 4-3	122

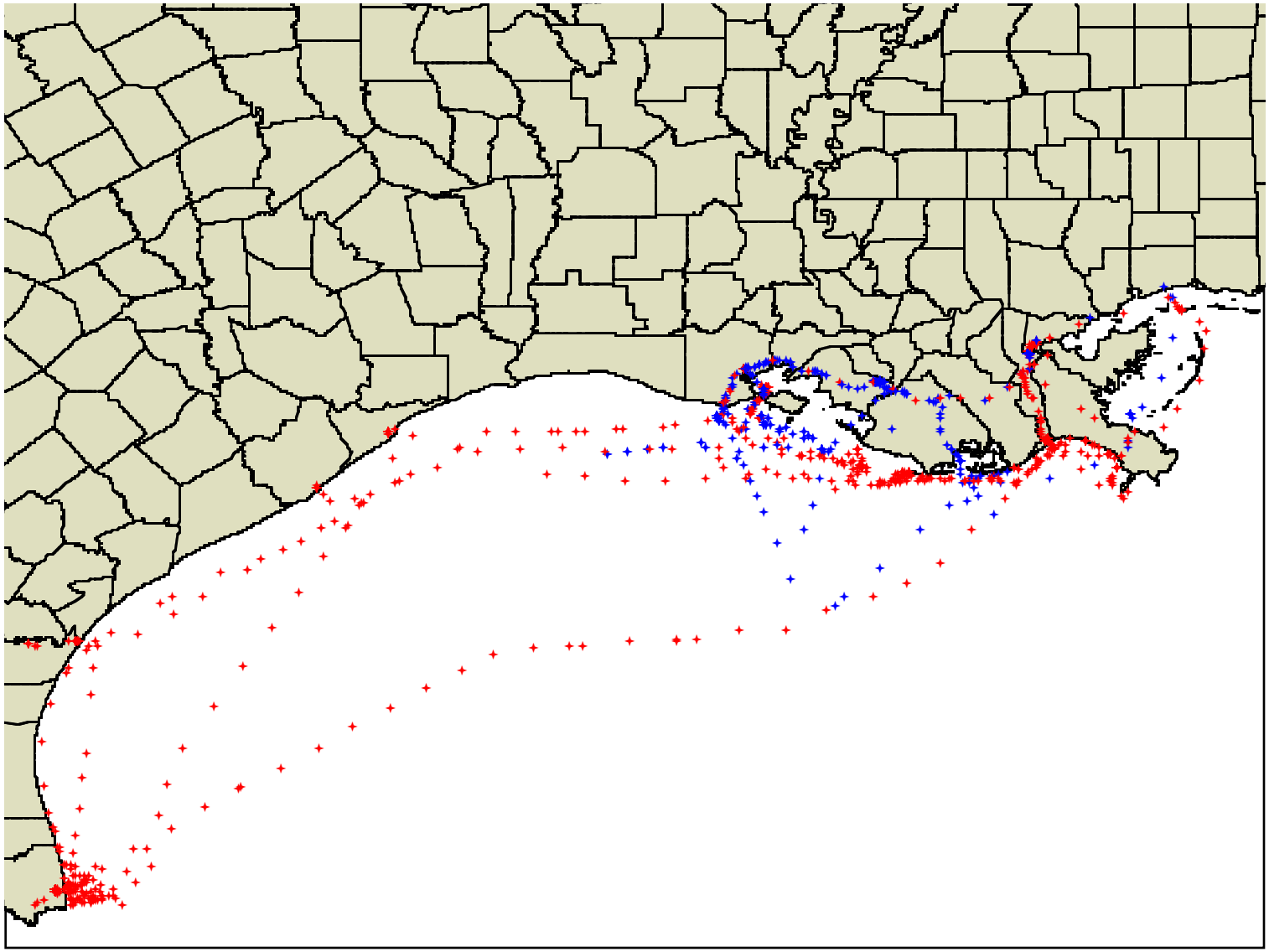


Figure 4-2 WPB Coverage Area. Point Sal is in red, Point Winslow is in blue.

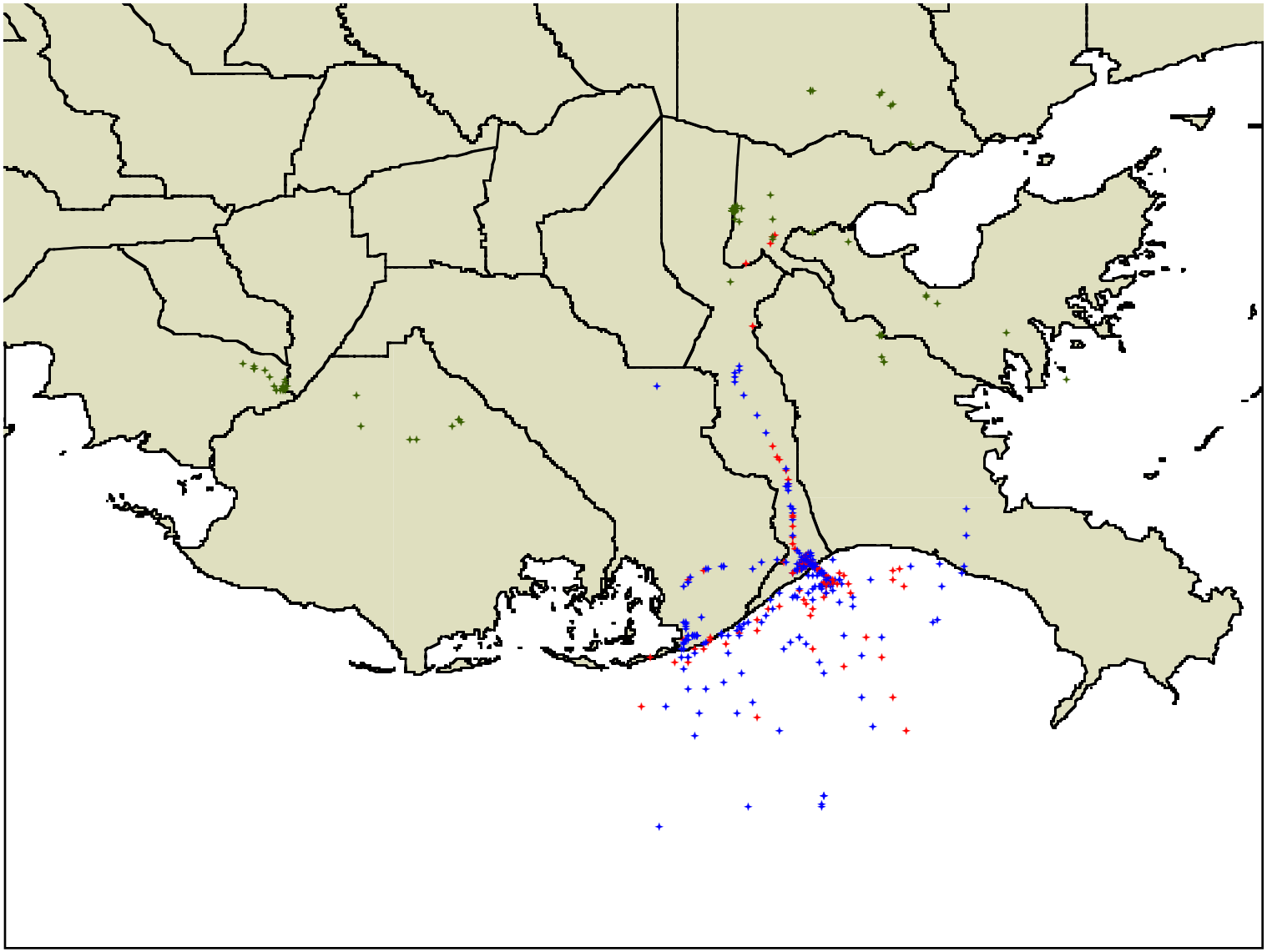


Figure 4-3 UTB and RHIB Coverage Area. UTBs are plotted in red and blue, the RHIB is plotted in green.

4.3 POSITION ACCURACY

The self-positioning accuracy of the system was evaluated by recording numerous transmitted positions and comparing to a DGPS reference position (actually, position reports aren't transmitted per se, the unit's position is calculated at the Earth Station based upon the unit's transmission being received by two satellites). This was done using a unit located on the roof of the R&D Center. This unit was also relocated for a while to the roof of ESD New Orleans for additional testing.

The results of the two tests are compared in Table 4-2. As can be seen, 95% of the time the positions are within 290 m (at ESD NOLA) or 313 m (at RDC). This is what the system accuracy is claimed to be. Other standard statistics are as listed in the table. The final line is the distance of the average position (average of all reports) from the reference location. This data is also presented graphically in scatterplots to see this same information visually.

Table 4-2 BOATRACS System position accuracy statistics.

	ESD NOLA	RDC
95% Radial error (m)	290.14	313.90
100m Percentile	36.7%	42.7%
Mean (m)	140.75	134.30
Median (m)	123.75	114.05
Mode (m)	74.05	20.83
Minimum (m)	8.10	15.46
Maximum (m)	937.35	648.65
Count	540	1640
Reference Position		
Lat	29.9676	41.3171
Long	-90.0270	-72.0637
Average of Positions		
Lat	29.9668	41.3170
Long	-90.0269	-72.0635
Distance from Ref (m)	83.31	18.39

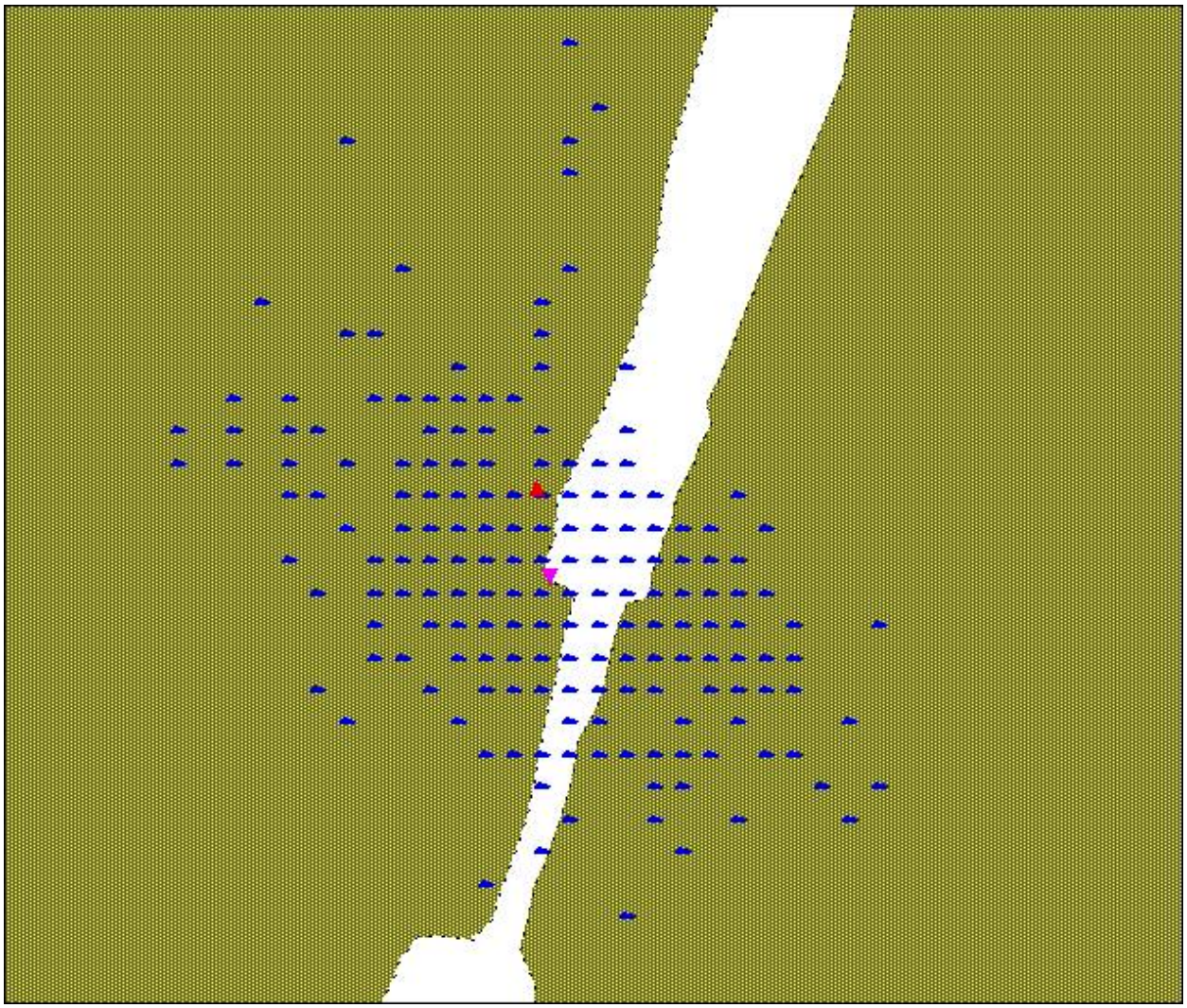


Figure 4-4 Scatter plot of positions from the MCT located on the roof of the ESD New Orleans building. The actual (DGPS) position is indicated in red. The average of all of the BOATRACS positions is indicated in pink.

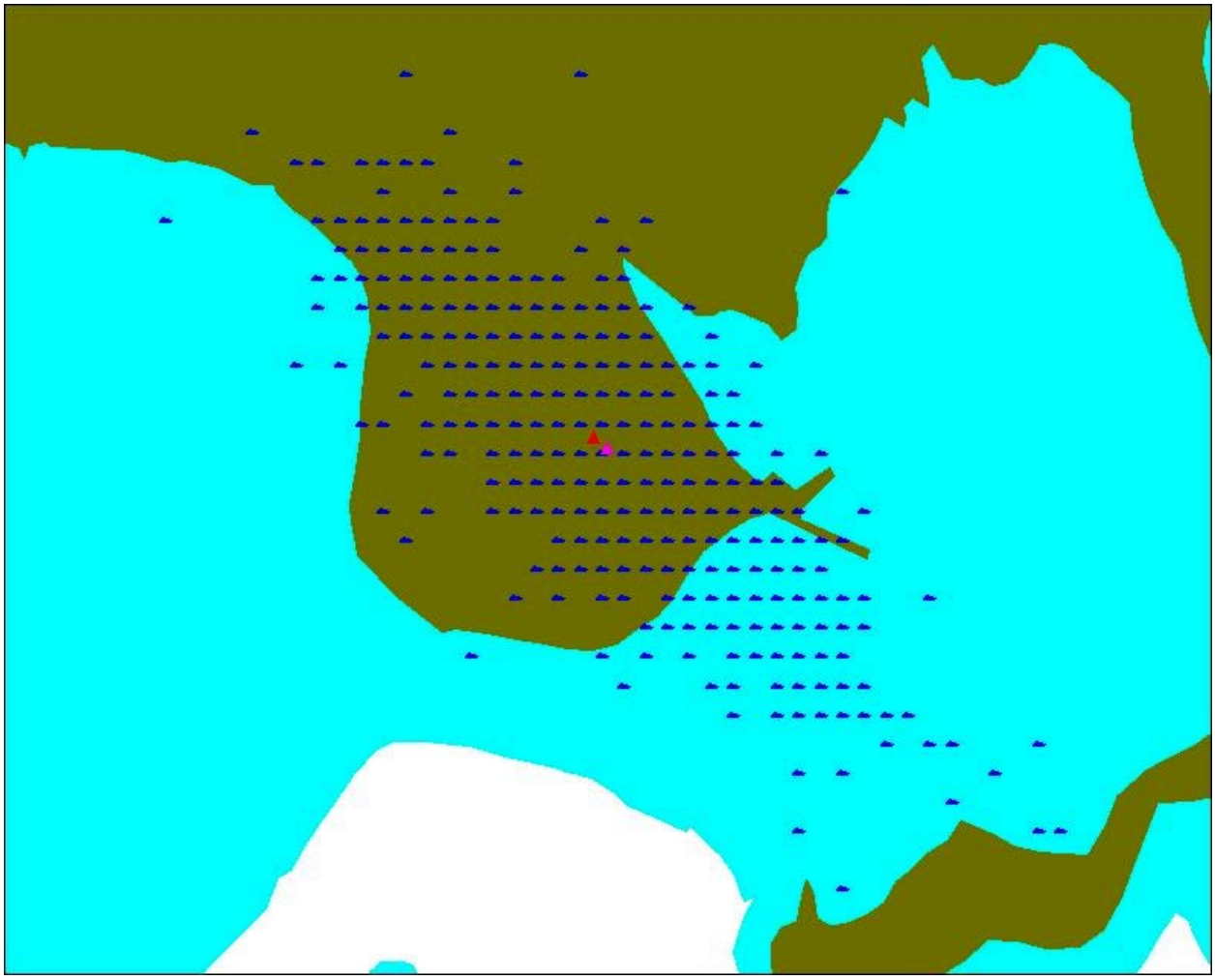


Figure 4-5 Scatter plot of positions from the MCT located on the roof of the R&D Center. The actual (DGPS) position is indicated in red. The average of all of the BOATRACS positions is indicated in pink.

The following two histograms show the distribution of the position errors. Figure 4-6 is for the MCT at ESD NOLA and Figure 4-7 is for the MCT at the R&D Center. In the histograms, the heights of the bars illustrate the number of times that the position error was a certain radial distance (in meters). As can be seen, most of the position errors are less than 200 m, with the largest concentration of errors ranging from 75 to 165 m.

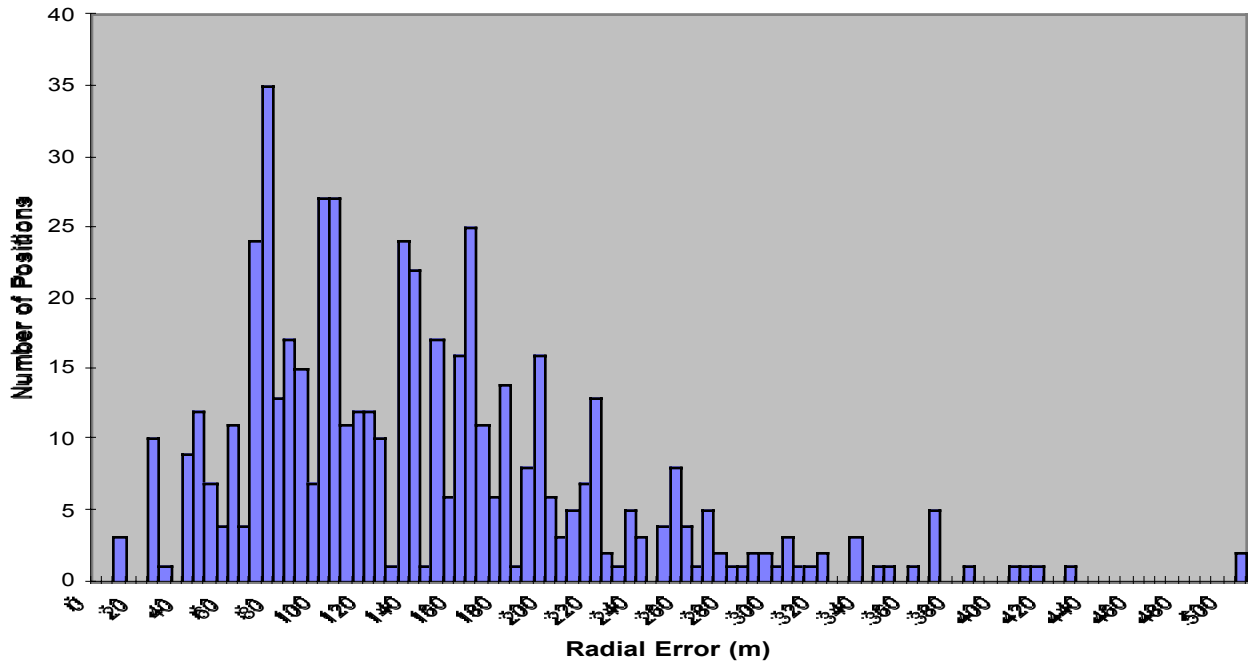


Figure 4-6 Histogram of position errors for MCT at ESD NOLA (530 Position Reports).

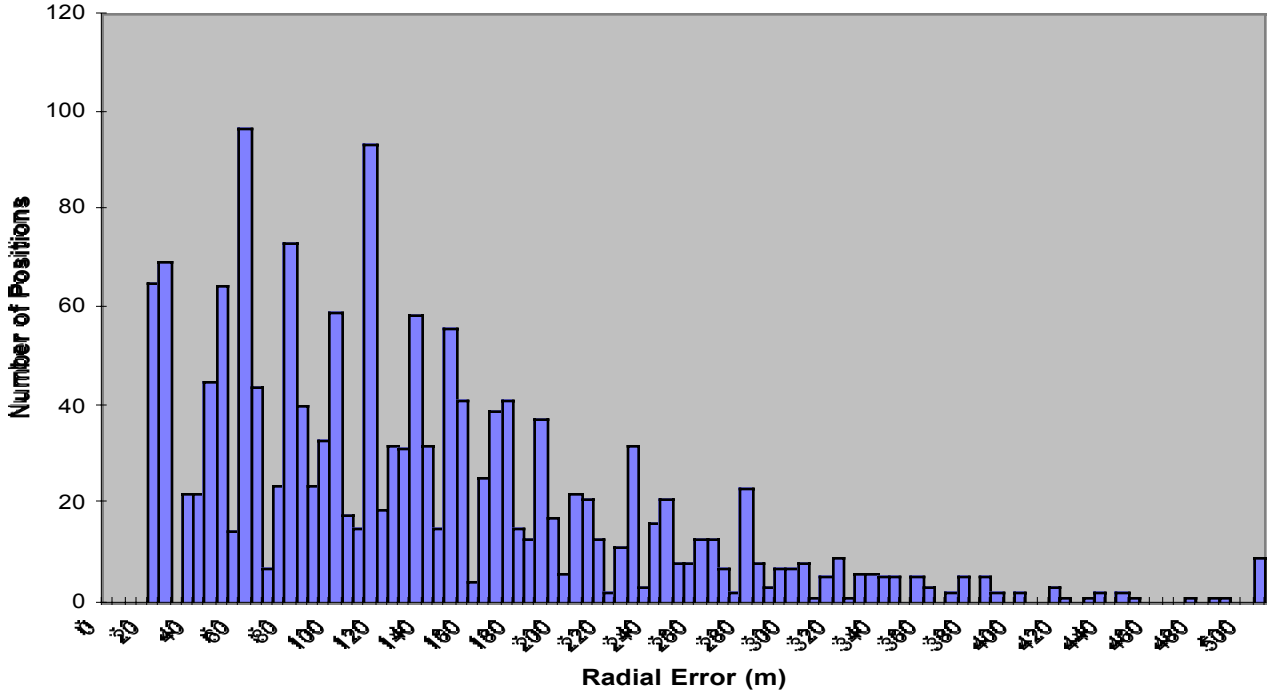


Figure 4-7 Histogram of position errors for MCT at RDC (1640 Position Reports).

4.3.1 Cost

The chart below shows the amount of messages each unit transmitted/received. One 41 ft UTB was used more often than the other one was. The great number of messages sent by the UTBs is an indicator of their lack of other communications options.

The BOATRACS units cost around $5000 per unit (quantity discounts are available). Installation costs are fairly inexpensive. All of the units used in this test were installed by ESD New Orleans. Some units required brackets or mounts to be fabricated, but the total installation cost per unit was less than $500.

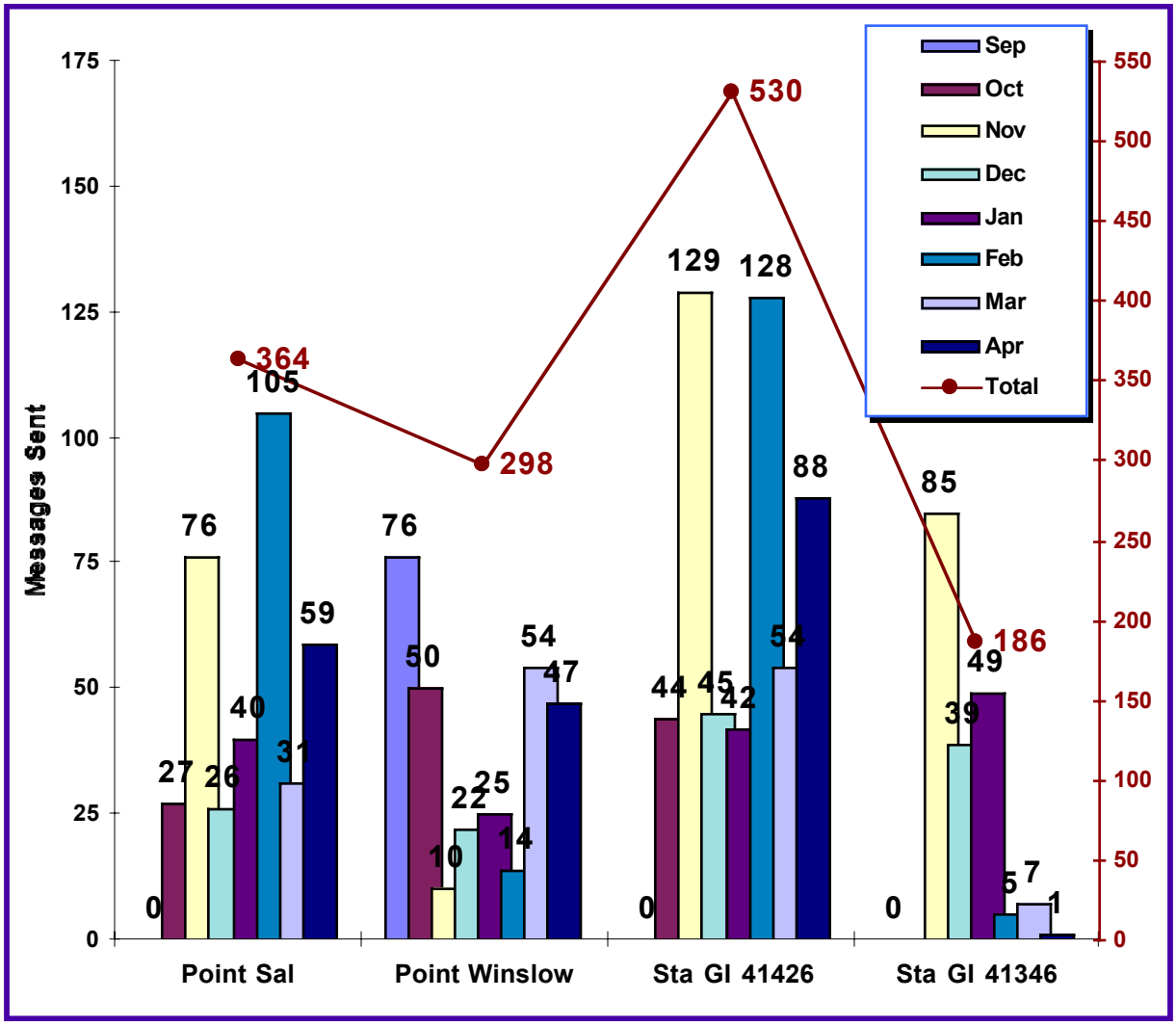


Figure 4-8 BOATRACS Usage by unit. Individual bars indicate usage per month. The red line indicates total usage (read using scale at right). Usage numbers are number of messages sent. or received.

To compare the costs of using the BOATRACS system to using Cellular, each BOATRACS message was converted to an equivalent cellular phone call and the cost for that call assessed. Some very conservative assumptions are made for the length of a typical call and the assessment of roaming fees. Actual cellular costs would probably be much higher than indicated here. In the

graph below, the BOATRACS messaging costs for the units are compared to the equivalent cellular costs. The costs for the two 41' UTBs at Grand Island have been combined. BOATRACS costs for the units are marked with circles. The equivalent cellular costs are marked with squares. Each unit is in a different color. As you can see, the BOATRACS costs are typically much lower than the cost would have been to send the same information via cellular phone. The detailed data and assumptions are in Appendix B-2. The cost differences are summarized in Table 4-3 below.

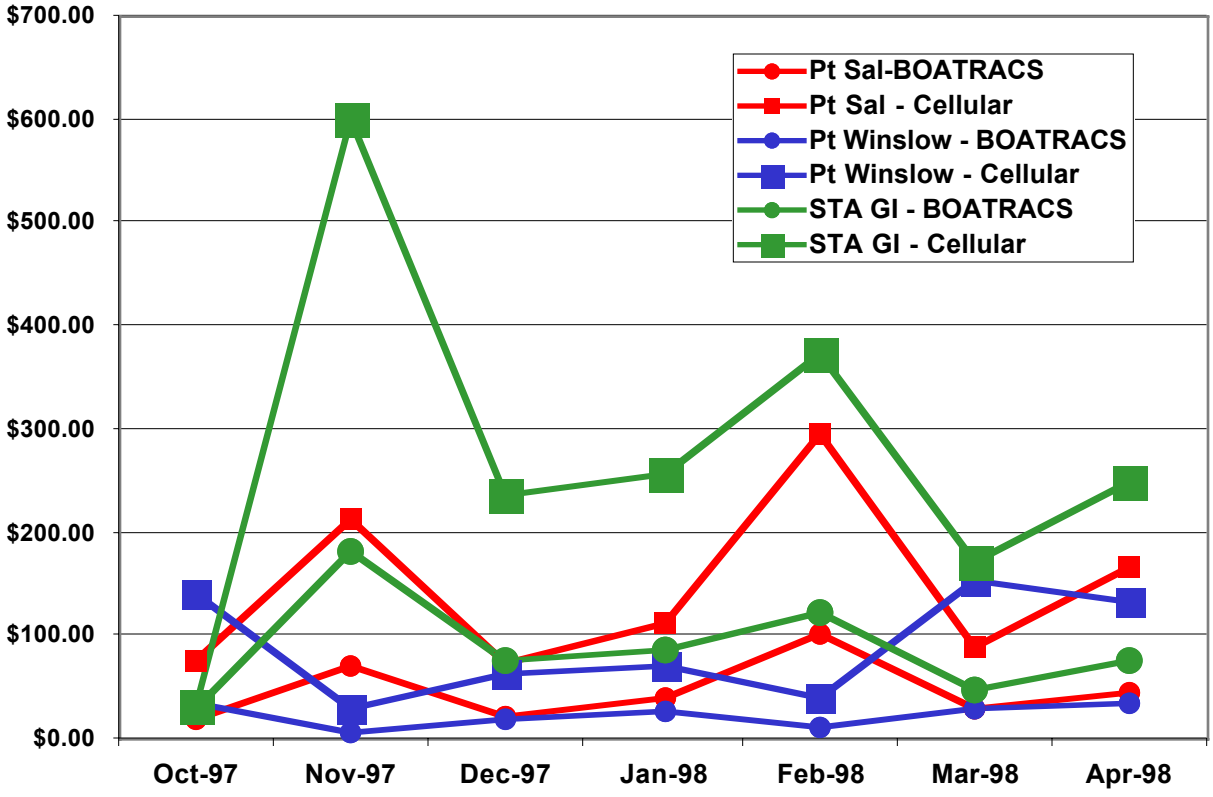


Figure 4-8 BOATRACS versus equivalent cellular usage costs.

Table 4-3 BOATRACS and equivalent cellular cost summary data.

Unit	Point Sal	Point Winslow	Grand Isle
Total Messages	364	22	716
Avg. msgs/mos	52	32	102
Avg. BOATRACS Cost/mos	$46.09	$22.23	$87.29
Avg. cellular cost/mos	$127.40	$77.70	$239.16
Avg. savings/mos	**$81.31**	**$55.47**	**$151.87**

4.3.2 Availability

Availability was good except when the line-of-sight to the satellite was obscured; such as when the units were behind an oilrig or under a bridge. Some units experienced intermittent outages when operating in heavy weather (rough seas and rain that combined to reduce the signal strength). However, it did not keep messages from going through.

4.3.3 Intraoperability

Intraoperability was only evaluated through the use of e-mail, which worked fine. The MCTs could be used to send and receive Internet e-mail. Also, the system has the capability of sending and receiving generic files (such as images or Office documents). This capability was not used however.

4.3.4 Reliability

Reliability was good on all units except the RHIB. That boat had some power supply problems that still need to be resolved. The power system on the boat experienced voltage spikes that were damaging the electronics (including the MCT). Also, when the antennas were removed from the 41 ft UTBs it was noticed that corrosion had started to build up on the exterior. This did not affect performance; however, BOATRACS has an antenna cover that can be used to prevent this in locations exposed to a lot of salt spray.

4.3.5 Operational Performance

The Operational Performance Parameters were evaluated. Many users prefer voice communications for certain functions, but data communications are a valuable addition. The users most liked the fact that the system provided reliable communications throughout the AOR--especially in areas where VHF, HF, and cellular coverage was poor. Detailed user comments and feedback are included in Appendix C.

5. CONCLUSIONS

The system was easily installed on all vessel types tested (WPB, UTB and 19 ft RHIB). Some difficulties were experienced on the RHIB with the DC power system, but this has been resolved. The reliability of the BOATRACS hardware was very good.

Messages are sent and received fairly quickly. In the lab, forward messages took less than a minute and return messages about 5 minutes. E-mail connectivity was slightly longer at 6 minutes in the forward direction and 8 minutes for return. This is acceptable for routine,

operational, and administrative messages. It might not be sufficiently timely for emergency messages however. The biggest complaint on the user side was the slow response from shore. This was typically due to a long dial-up interval on the QTRACS software. If the shore sites had dedicated lines or Internet connectivity, than this delay would not be a problem.

Coverage was very good. As expected, there was no location in the AOR that did not have coverage. Availability was almost 100%. This was the biggest asset of the system to the users: they knew that they would always have communications coverage, even when all other systems were unavailable. This test was run because there are so many areas in the AOR where communications are poor or nonexistent.

The accuracy of the position reports was in line with the stated accuracy of 300 m. Although not as accurate as GPS, and insufficient for navigation, it is more than accurate enough for shoreside watchstanders to monitor the position of assets. Although this feature works well, it was not frequently used by shore personnel due to lack of familiarity with the capability and operational procedures that specify other modes of operation.

The system turned out to be much cheaper than cellular. In fact the numbers used in the report are somewhat conservative. Typically, voice calls average more than 3 minutes (vice the 2 minutes used). Also, in the New Orleans area, cellular roaming is very expensive. The cost of roaming was not reflected in the cost comparison. In other areas with cheaper cellular and larger home areas the cost advantage would be less.

Many users were new to using data systems and were used to using voice for all communications. That is still the mode preferred for many functions. However, there were many cases where the data capability was very useful such as for EPIC checks, boarding reports, and termination cases; anything where a lot of information needed to be communicated accurately. With more operational guidance and procedures in place, a system such as this could be used much more advantageously. However, for these classes of vessels, the system needs to be kept simple and easy to use. That was one of the advantages of the BOATRACS system.

In conclusion, a data system such as this can add a valuable capability to units of these classes. In addition, in this AOR with the severe communications deficiencies, it provides, in many cases, the **only** communications capability. It is not a replacement for traditional voice communications, but an enhancement. There are many functions that can be done more easily and more quickly with a data system; however, some things are still best done using voice circuits. For units that are supplementing CG VHF frequencies with cellular phones, this offers a cheaper alternative.

6. REFERENCES

1. Gregory Johnson, Jon Turban, Robert Erickson, “Technology Assessment of Mobile Satellite System Alternatives,” USCG R&D Center report, April 1998.
2. BOATRACS web site, http://www.boatracs.com/
3. OmniTRACS web site, http://www.omnitracs.com/OmniTRACS/

7. ACRONYMS

AC	Alternating Current
AOR	Area Of Responsibility
BER	Bit Error Rate
BERT	Bit Error Rate Test
bps	bits per second
Bps	Bytes per second
CDMA	Code Division Multiple Access
CG	(US) Coast Guard
cm	centimeter (0.01 m)
CONUS	CONtinental United States
dB	Decibel
DC	Direct Current
DGPS	Differential GPS
ESD	Electronics Support Detachment
fax	facsimile
FCC	Federal Communications Commission
FEC	Forward Error Correction
FM	Frequency Modulation
GHz	Giga-Hertz (1,000,000,000 Hertz)
GPS	Global Positioning System
HF	High Frequency
Hz	Hertz (cycles per second)
IP	Internet Protocol
kbps	kilobits per second (1,000 bps)
Kbyte	Kilobyte, file size of 1024 bytes
KDU	Keyboard Display Unit
kg	kilogram (1,000 grams)
kHz	kiloHertz (1,000 Hertz)
LAN	Local Area Network
Lat	Latitude
lbs	U.S. pounds
Long	Longitude
m	meter
Mbyte	Megabyte, file size of 1024 Kbytes
MCT	Mobile Communications Terminal
MHz	MegaHertz (1,000,000 Hertz)
min	minutes
mos	month
ms	millisecond (0.001 second)
mW	milliWatt (0.001 W)

NCC	Network Control Center
NCS	Network Control Station
NiCad	Nickel-Cadmium
NM	Nautical Miles
NOLA	New Orleans Louisiana
NSA	National Security Agency
PC	Personal Computer
POP3	Post Office Protocol version 3
PSTN	Public Switched Telephone Network
R&D	Research and Development
RDC	R&D Center
RHIB	Rigid Hull Inflatable Boat
SCADA	Supervisory, Control, And Data Acquisition
SIM	Subscriber Identity Module
SMTP	Simple Mail Transfer Protocol
SSW	South South-West
T&E	Test and Evaluation
TCP	Transmission Control Protocol
TDM	Time Division Multiplexing
TDMA	Time Division Multiple Access
UTB	UTility Boat
USCG	United States Coast Guard
Vac	Volts, AC
Vdc	Volts, DC
VHF	Very High Frequency
W	Watt
WPB	Coastal Patrol Boat

Appendix A

A-1 BOATRACS terminal specifications

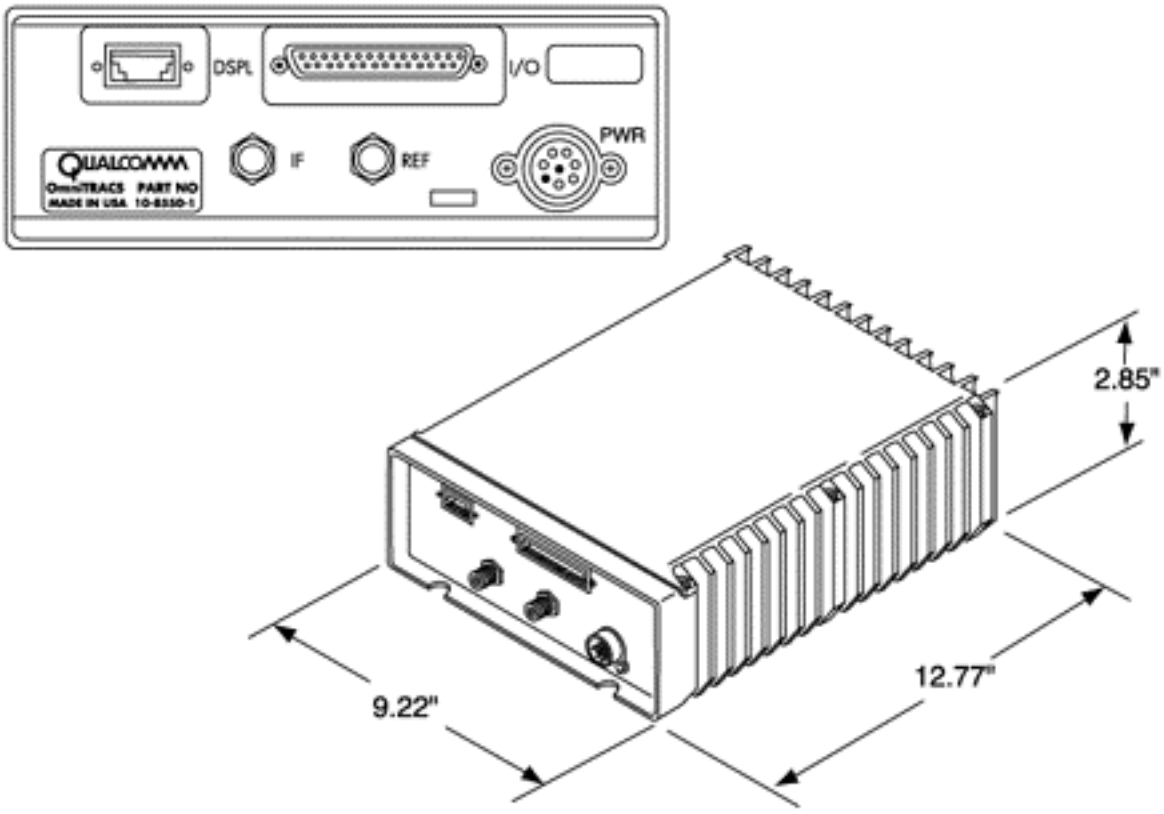
A-1 BOATRACS terminal specifications

Communication Unit

The BOATRACS system is a store-forward messaging system. Essentially, this means that messages sent by vessels are relayed via satellite to the earth station, where they are then stored in an electronic mailbox. Once the earth station receives a message it is held until the shore-based computer automatically dials in and collects the message from their mailbox. The messages also can be printed or routed on a LAN for distribution. This communications system allows the home office to respond with the click of a button and send a reply back to the vessel or the entire fleet. The service operates 24 hours a day providing year-round access to messaging and emergency services.

The Communications Unit is 12.8 inches long, 9.2 inches wide, 2.9 inches high and weighs 7 pounds. The maximum message size is 1900 characters. The Unit can store up to 99 messages or 600 lines in memory. It is constructed of ruggedized cast aluminum.

Here's a schematic:



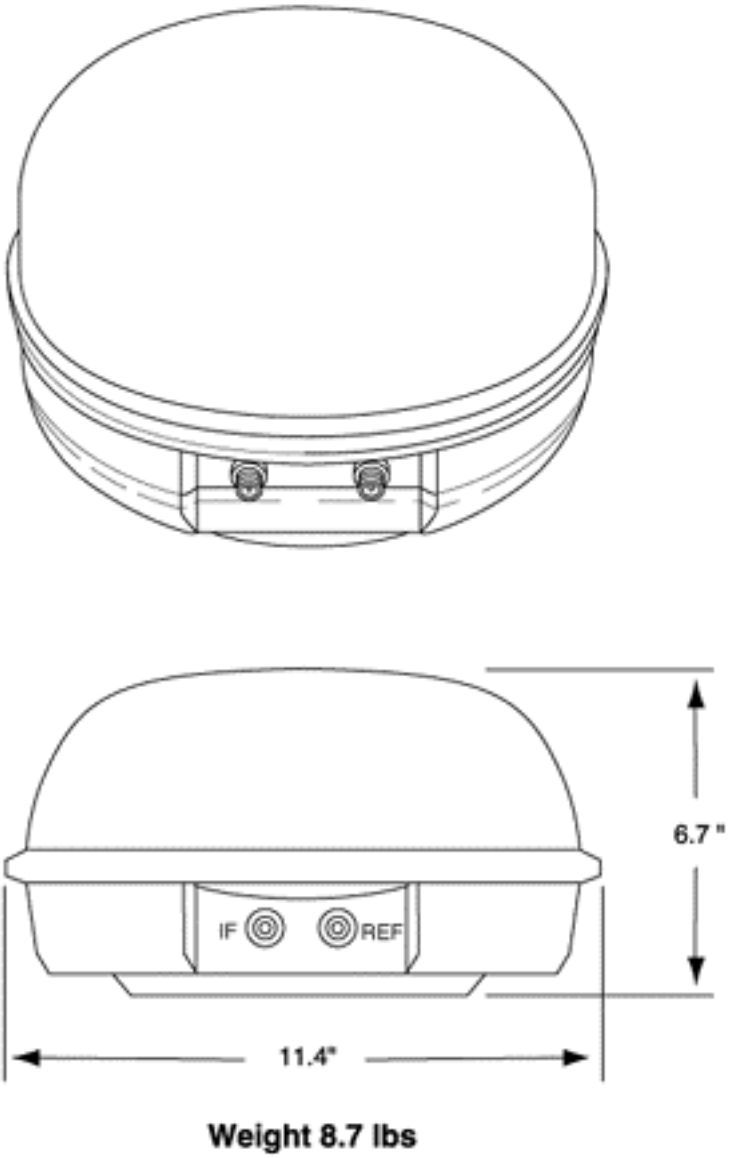
Antenna

QUALCOMM's development of the OmniTRACS system was made possible by an innovative, proprietary Ku-band antenna design. This technical breakthrough makes it possible to manufacture an affordable, yet highly reliable unit. The OmniTRACS antenna is encased in an aerodynamic dome and an electronically driven motor directs the antenna toward the satellite at

all times. This directional antenna permits the highest data rates, the most error-free transmissions and the greatest degree of reliability.

The Antenna, or Outdoor Unit, is 6.75 inches high and weighs 8 pounds. The dome is 11.6 inches in diameter. The Antenna operates on Ku band frequency.

Here's a schematic:



Weight 8.7 lbs

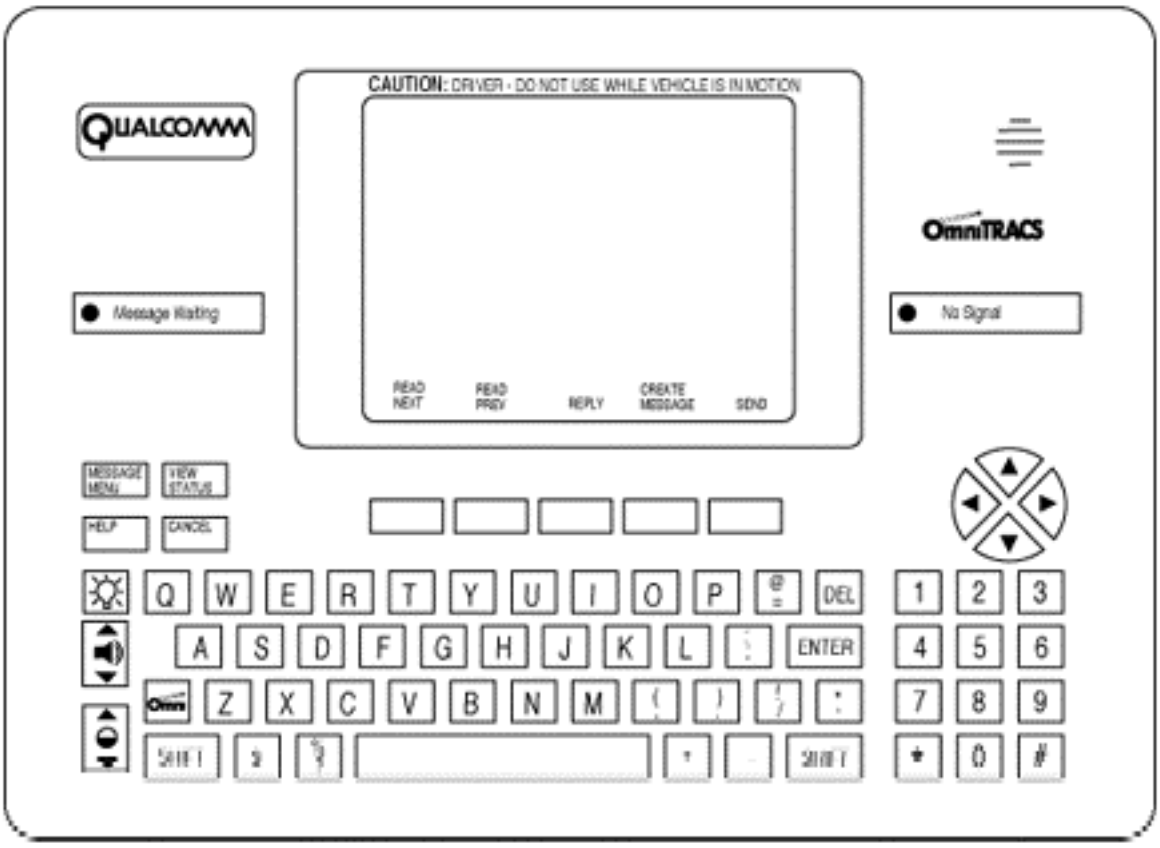
Enhanced Display Unit

Now available worldwide - The Enhanced Display Unit (EDU) makes user input easier and more accurate than ever before. This 15-line EDU is an option to the standard 4-line keyboard display unit, and is plug compatible as a replacement for existing 4-line units. The 15-line x 40 character screen lets you view both text and graphics. The keyboard has been widened for easier data

entry, and sealed to protect against damage from spills. Keys are backlit to improve night-time performance. And a new clip-in holster makes one-hand removal a snap.

The Enhanced Display Unit is 12.8 inches wide, 9.3 inches long, 2.2 inches thick and weighs 3 pounds. The EDU can display 15 lines at 40 characters per line.

Schematic:



Appendix B

B-1 Detailed Latency Test Data

B-2 Detailed Cost Model Data

B-1 Latency Trials

Table B-1 Forward Messages

Forward								
ID	Date	Size	Queue	XMT	RCV	Queue Time	Transit Time	Total Time
500	5/6/98	65	13:50	13:50	13:50	0:00	0:00	0:00
501	5/6/98	591	14:03	14:03	14:03	0:00	0:00	0:00
502	5/6/98	1142	14:03	14:03	14:05	0:00	0:02	0:02
504	5/6/98	1012	14:22	14:22	14:23	0:00	0:01	0:01
						hh:mm	hh:mm	hh:mm
Average						0:00:00	0:00:45	0:00:45

Table B-2 Return Messages

Return								
ID	Date	Size	Queue	XMT	RCV	Queue Time	Transit Time	Total Time
600	5/6/98	189	13:14	13:14	13:15	0:00	0:01	0:01
601	5/6/98	677	14:42	14:42	14:45	0:00	0:03	0:03
602	5/6/98	677	14:42	14:45	14:47	0:03	0:02	0:05
603	5/6/98	677	14:42	14:45	14:49	0:03	0:04	0:07
604	5/6/98	189	14:43	14:49	14:50	0:06	0:01	0:07
						hh:mm	hh:mm	hh:mm
Average						0:02:24	0:02:12	0:04:36

Table B-3 Forward E-mail

Forward								
ID	Date	Size	Queue	XMT	RCV	Queue Time	Transit Time	Total Time
100	5/4/98	2179	15:09	15:09	15:14	0:00	0:05	0:05
101	5/4/98	2179	15:37	15:38	15:40	0:01	0:02	0:03
102	5/4/98	2179	15:38	15:38	15:42	0:00	0:04	0:04
103	5/4/98	1144	15:40	15:40	15:44	0:00	0:04	0:04
104	5/4/98	1144	15:40	15:40	15:45	0:00	0:05	0:05
105	5/6/98	1143	15:58	15:58	16:06	0:00	0:08	0:08
106	5/6/98	1143	15:58	15:58	16:04	0:00	0:06	0:06
107	5/6/98	2178	15:58	15:58	16:02	0:00	0:04	0:04
108	5/6/98	2178	15:58	15:58	16:08	0:00	0:10	0:10
109	5/6/98	2178	15:58	15:58	16:09	0:00	0:11	0:11
						hh:mm	hh:mm	hh:mm
Average						0:00:06	0:05:54	0:06:00

Table B-4 Return E-mail

Return								
ID	Date	Size	Queue	XMT	RCV	Queue Time	Transit Time	Total Time
200	5/4/98	680	13:42	13:50	14:00	0:07	0:09	0:17
201	5/4/98	767	15:20	15:20	15:24	0:00	0:04	0:04
202	5/4/98	862	15:57	15:57	16:00	0:00	0:03	0:03
203	5/4/98	541	16:01	16:01	16:08	0:00	0:07	0:07
204	5/6/98	608	9:22	9:22	9:28	0:00	0:06	0:06
205	5/6/98	1076	9:27	9:27	9:34	0:00	0:07	0:07
						hh:mm	hh:mm	hh:mm
Average						0:01:18	0:06:08	0:07:26

B-2 Detailed Cost Model Data

Unit:	Pt. Sal				Pt. Winslow				Grand Island			
MCT#:	219957				227405				224866, 224318			
	Messages	Characters	BOATRACS Cost	Equivalent Cellular Cost	Messages	Characters	BOATRACS Cost	Equivalent Cellular Cost	Messages	Characters	BOATRACS Cost	Equivalent Cellular Cost
Oct-97	27	976	$17.40	$75.60	50	2305	$34.22	$140.00	44	1309	$27.24	$31.68
Nov-97	76	8251	$71.00	$212.80	10	132	$5.53	$28.00	214	18398	$180.59	$599.20
Dec-97	26	2221	$21.88	$72.80	22	1686	$17.74	$61.60	84	8308	$75.23	$235.20
Jan-98	40	4520	$38.08	$112.00	25	3193	$25.27	$70.00	91	10252	$86.51	$254.80
Feb-98	105	12298	$101.69	$294.00	14	1032	$11.13	$39.20	133	13408	$120.13	$372.40
Mar-98	31	3064	$27.76	$86.80	54	435	$28.74	$151.20	61	4291	$47.66	$170.80
Apr-98	59	3835	$44.84	$165.20	47	2362	$32.95	$131.60	89	7292	$73.67	$249.20
May-98				$0.00				$0.00				$0.00
Total	364	35165	$322.65	$1,019.20	222	11145	$155.58	$621.60	716	63258	$611.03	$1,913.28
Average	52	5024	$46.09	$127.40	32	1592	$22.23	$77.70	102	9037	$87.29	$239.16
			Average monthly savings	$81.31			Average monthly savings	$55.47			Average monthly savings	$151.87

Cellular Cost Assumptions

Each message would be one phone call

The average phone call is 2 minutes long

		RadioPhone Cost/Min	Cell Cost/Min
Cost/minute	$1.40	$1.14	$0.26
Surcharge/ Call	$0.00		

Cellular Cost Assumptions

Each message would be one phone call

The average phone call is 2 minutes long

		RadioPhone Cost/Min	Cell Cost/Min
Cost/minute	$0.36	$0.00	$0.36
Surcharge/ Call	$0.00		

Appendix C

User Feedback Forms

C-1 Point Winslow

C-2 Station Grand Isle

C-3 Station New Orleans

C-4 Group New Orleans

C-5 Point Sal

C-1 Point Winslow User Feedback Forms

BOATRACS TEST EVALUATION GUIDE

Unit: USCGC Point Winslow

Personnel Using System: OinC, BM1, BM2 (OOD's)

System Technical Performance

Availability

Is the system always operational?

- In trouble log, document any difficulties in sending messages.

Any times the system was inoperable? (list and describe)

Very few times the system was inoperative. Under a bridge or near oil rig (3,800 rigs in Gulf!) would lose signal but regain very quickly. 10/29 0900 No signal approx. 1 hr. 10/31 0700 no signal approx. 1 hr. 2/12 1840 no signal approx. 45 min.

Any times the BOATRACS was the only method of communication? (list and describe)

No. Cellular coverage throughout Gulf (at least within areas Winslow has operated). Stayed in AOR so had cell coverage. Don't always have VHF and many times HF is also very poor.

Are all messages rcvd?

- In trouble log document any time unable to send message. On shore side, track if messages sent not received by mobile.

Any times you were unable to send/receive messages? (list and describe)

Once, 1/20 2200, Daily Boarding report sent to GRU and never rcvd.

Did the system perform in all weather conditions?

- In trouble log document any instances of failure due to poor wx.

Any times the weather prevented the system from working? (list and describe)

No weather problems. Operated in 15' seas with no problems.

Reliability

Did the system ever fail?

- In trouble log track all equipment failures, and time to repair.

Any equipment failures? If so how long to get fixed? (list and describe)

None. 2/11 GRU down until 1240 2/12.

System Operational Performance

Data communications

How valuable was the ability to have data communications with these assets.

- Cite examples, time savings? money savings? Performance enhancements?

Was the data capability useful? (If no, why not. If yes, why?)

Small screen size was a drawback, Laptop would be better. Fill in blanks on template is good. Concern raised about additional workload on OOD if cutter has data capability (no QMOW like on larger cutter). Need to keep it simple and at realistic workload level.

Any examples of how data communications improved efficiency or performance? (list and describe)

GRU radiomen would call on radio or send BOATRACS message asking for position and ops. No need for this. Training issue with GRU.

Did the data communications capability save any time/make your job easier? (list and describe)

Most stuff sent/rcvd has been short; 1 sentence type of things. Have not used it for some things because of concern over how long response time would be (Group must dial up—currently on 10min schedule).

Real-time vessel locations

How valuable was the ability to have a real-time location on these units?

- Cite examples, time savings? money savings? Performance enhancements?

Did you make use of the position reporting capability? (If no, why not, if yes, was it beneficial?)

Group didn't always make appropriate use of this function (see comment above).

[I think this was corrected later in evaluation]

Did the position reports save you time? (list and describe)

Did the position reporting improve efficiency of operations or improve performance? (list and describe)

Protected Communications

How valuable was the ability to protected communications to these units?

- Cite examples, time savings? money savings? Performance enhancements?

Since BOATRACS provides a more protected communications path than cellular, was this capability important or useful? (list and describe)

Don't discuss sensitive things over cellular. Have always used ANDVT for these functions. Have used BOATRACS for some sensitive issues due to it's being less likely to be intercepted than cellular.

Ease of use

How easy was the system to use?

- How much training was required? How long did it take to become proficient in using?

Were you able to use the system successfully?

Yes

Did you receive sufficient training in the use? How much training time is required?

Yes, very easy to use.

Efficiency improvements

Was there any improvement to operational efficiency?

- Manpower savings? Time savings?

Any improvements to operational efficiency or performance not already discussed? (list and describe)

Used it everywhere they could think of—no other applications.

General Comments

Any general comments/remarks not already discussed?

LCD not readable in direct sunlight.
Reduced some cell phone usage such as notifying Group when underway, responding to questions, and short questions and answers.
Satellite voice would be preferred over satellite data.
Can get by without it but would like to keep it if it is cost effective (cheap/affordable).
Would rather have cell phone than BOATRACS ‘cause need [prefer] voice.

C-2 Station Grand Isle User Feedback Forms

BOATRACS TEST EVALUATION GUIDE

Unit: Station Grand Island (station perspective)

Personnel Using System: CO, OOD's

System Technical Performance

Availability

Is the system always operational?

- In trouble log, document any difficulties in sending messages.

Any times the system was inoperable? (list and describe)

One time computer worked for a while then was getting no carrier (very poor phone lines at Grand Isle – FTS was busy). Otherwise computer worked fine.

Any times the BOATRACS was the only method of communication? (list and describe)

Yes. When out of cell phone range or secure VHF range. In past would have to use VHF non-secure to communicate.

Are all messages rcvd?

- In trouble log document any time unable to send message. On shore side track if messages sent not received by mobile.

Any times you were unable to send/receive messages? (list and describe)

Some messages hit reply-message never received (poor weather? Unkown?). Some messages sent to boat and never received. Picked up radio to call. [very small number of circumstances, possibly due to operator error. RDC or BOATRACS were never notified, so unable to troubleshoot problem]

Did the system perform in all weather conditions?

- In trouble log document any instances of failure due to poor wx.

Any times the weather prevented the system from working? (list and describe)

Not applicable for shore computer.

Reliability

Did the system ever fail?

- In trouble log track all equipment failures, and time to repair.

Any equipment failures, if so how long to get fixed? (list and describe)

None.

System Operational Performance

Data communications

How valuable was the ability to have data communications with these assets.

- Cite examples, time savings? money savings? Performance enhancements?

Was the data capability useful? (If no, why not. If yes, why?)

CO sees very little need for data communications except for LE information.

Any examples of how data communications improved efficiency or performance? (list and describe)

Did the data communications capability save any time/make your job easier? (list and describe)

Real-time vessel locations

How valuable was the ability to have a real-time location on these units?

- Cite examples, time savings? money savings? Performance enhancements?

Did you make use of the position reporting capability? (If no, why not, if yes, was it beneficial?)

Not useful to CO. Didn't really care exactly where boats are. OPS Normal reports not labor intensive.

Did the position reports save you time? (list and describe)

Did the position reporting improve efficiency of operations or improve performance? (list and describe)

Haven't had any cases (since CO there) where lost communications with 41 and had to launch helo. Usually have direct communications with boats through Group (high sites). Usually boats stay fairly close within area so don't usually get out of coverage. Don't usually go to edge of AOR; they rely on commercial sources for a lot of SAR (in the Bay).

Protected Communications

How valuable was the ability to protected communications to these units?

- Cite examples, time savings? money savings? Performance enhancements?

Since BOATRACS provides a more protected communications path than cellular, was this capability important or useful? (list and describe)

For LE ops. Use BOATRACS for more security so don't transmit on VHF to send OPS Normal reports.
CO: Only need he sees for system is as a backup for VHF-FM secure. Most OPS work fine on radio. Very rare that can't get contact with boat on VHF.
Also use it for EPIC checks. In the past would go in the clear or use cell phone..

Ease of use

How easy was the system to use?

- How much training was required? How long did it take to become proficient in using?

Were you able to use the system successfully?

Yes.

Did you receive sufficient training in the use? How much training time is required?

Yes.

Efficiency improvements

Was there any improvement to operational efficiency?

- Manpower savings? Time savings?

Any improvements to operational efficiency or performance not already discussed? (list and describe)

Don't need very much message capability to/from a 41'—only underway approx. 6 hours (10 max.) and there is not very much that is time sensitive.

General Comments

Any general comments/remarks not already discussed?

Don't need a tight track on units. Some use to automate reporting for Group. Would like to keep it as a backup for secure voice. Could have used it more on the RHIB because it goes to the edge of the communications coverage areas. Also RHIB has no secure voice other than MX300 which has very limited range. A smaller keyboard would be ideal for RHIB—perhaps menu driven like on a GPS receiver.

Would be nice if vessel could do LEIS II checks while underway (wants and warrants, etc.)

Needs to be quick and simple (within 5 min).

Data would be more useful if unit had SWS III and was integrated.

BOATRACS TEST EVALUATION GUIDE

Unit: Station Grand Island (boatcrew perspective)

Personnel Using System: All boatcrews (one meeting)

System Technical Performance

Availability

Is the system always operational?

- In trouble log, document any difficulties in sending messages.

Any times the system was inoperable? (list and describe)

At one point had an error code 1000 and system was inoperable for a while [did not notify RDC or BOATRACS so were unable to address problem). Also when next to Oil Rig, lost signal.

Any times the BOATRACS was the only method of communication? (list and describe)

Yes. Some times cell phone lost coverage (don't have RADIOPHONE satellite-cellular). Also, VHF Secure communications does not have very good range so used BOATRACS.

Are all messages rcvd?

- In trouble log document any time unable to send message. On shore side track if messages sent not received by mobile.

Any times you were unable to send/receive messages? (list and describe)

Yes, when station unable to dial-in (phone line problems). Sometimes sent messages to Group vice station (operator error/interface problem).

Did the system perform in all weather conditions?

- In trouble log document any instances of failure due to poor wx.

Any times the weather prevented the system from working? (list and describe)

When in 4-6' seas had periodic (short) outages. System still worked though and could still send messages.

Reliability

Did the system ever fail?

- In trouble log track all equipment failures, and time to repair.

Any equipment failures, if so how long to get fixed? (list and describe)

As mentioned above, 3 weeks on one boat had error code 1000. Problem went away on its own.

System Operational Performance

Data communications

How valuable was the ability to have data communications with these assets.

- Cite examples, time savings? money savings? Performance enhancements?

Was the data capability useful? (If no, why not. If yes, why?)

Yes. Liked data messages. There is an user-interface issue: since by default messages go to master account (Group) sometimes would send messages (incorrectly) to Group vice Station. Must reply to a message from the Station. Users would forget this. Also crews would forget they could pull up an old message from Station and reply to it, and would wait for the station to send them a message and then reply.

Any examples of how data communications improved efficiency or performance? (list and describe)

Sometimes difficult to get keyboard out (new location after STAN Team visit difficult to access).
Good for receiving things like positions—saves time from copying them over the radio. Also good for Administrative traffic. Would have used more if Group wouldn't see messages.

Did the data communications capability save any time/make your job easier? (list and describe)

For the most part was user-friendly. Screen was sometimes difficult to see in daytime. As mentioned above, the new location of keyboard was not as convenient. Something smaller would be better.

Real-time vessel locations

How valuable was the ability to have a real-time location on these units?

- Cite examples, time savings? money savings? Performance enhancements?

Did you make use of the position reporting capability? (If no, why not, if yes, was it beneficial?)

No, Station usually called on radio. Didn't really make use of this (continued to make voice OPS Normal reports every 30min).

Did the position reports save you time? (list and describe)

Did the position reporting improve efficiency of operations or improve performance? (list and describe)

Protected Communications

How valuable was the ability to protected communications to these units?

- Cite examples, time savings? money savings? Performance enhancements?

Since BOATRACS provides a more protected communications path than cellular, was this capability important or useful? (list and describe)

Needed a printer at the Station.
Yes, since no secure radio on RHIB would have been very useful there. Good replacement for VHF secure since range of VHF secure is very poor.
Slow messages coming back since waiting for time to dial-up [call schedule on shore computer set too long].

Ease of use

How easy was the system to use?

- How much training was required? How long did it take to become proficient in using?

Were you able to use the system successfully?

Yes.

Did you receive sufficient training in the use? How much training time is required?

Yes.

Efficiency improvements

Was there any improvement to operational efficiency?

- Manpower savings? Time savings?

Any improvements to operational efficiency or performance not already discussed? (list and describe)

General Comments

Any general comments/remarks not already discussed?

C-3 Station New Orleans User Feedback Forms

BOATRACS TEST EVALUATION GUIDE

Unit: Station New Orleans

Personnel Using System: Boatcrew (BM3's, BM2) and CO

System Technical Performance

Availability

Is the system always operational?

- In trouble log, document any difficulties in sending messages.

Any times the system was inoperable? (list and describe)

Coverage good. Including Oakdale and North Shore of lake.

Any times the BOATRACS was the only method of communication? (list and describe)

Yes. Radio communications typically poor. AOR is 750 sq. miles. Most of the time have cellular coverage; however, often is roaming. In NOLA, cell companies charge for roaming just for having the phone turned on.

Are all messages rcvd?

- In trouble log document any time unable to send message. On shore side track if messages sent not received by mobile.

Any times you were unable to send/receive messages? (list and describe)

No. BOATRACS has provided communications in all areas. Very dependable.

Did the system perform in all weather conditions?

- In trouble log document any instances of failure due to poor wx.

Any times the weather prevented the system from working? (list and describe)

No. Have not operated in rough weather.

Reliability

Did the system ever fail?

- In trouble log track all equipment failures, and time to repair.

Any equipment failures, if so how long to get fixed? (list and describe)

Yes. Have been having power problems on boat. Original and replacement MCT failed. Power problems have also killed two GPS units and one RADAR.

System Operational Performance

Data communications

How valuable was the ability to have data communications with these assets.

- Cite examples, time savings? money savings? Performance enhancements?

Was the data capability useful? (If no, why not. If yes, why?)

In one case, a shrimp boat catch seizure of 5000 lbs., the system worked well. Very quick. Was very useful during the 12 hr boarding. Was only communications method. On the negative side, the way this type of unit conducts boardings is tie off alongside and the entire crew goes onboard the other vessel. The MCT is connected to the RHIB so cannot be brought onboard so must return to the RHIB to send messages. Also, message received tone cannot be heard onboard the other vessel, so have been using pager to notify boarding officer when a message has been sent to them via BOATRACS.

Any examples of how data communications improved efficiency or performance? (list and describe)

In most cases would rather talk to someone than send messages.
Currently, biggest drawback is that it is not an instant response.

Did the data communications capability save any time/make your job easier? (list and describe)

Set the QTRACS to poll every 3 minutes when RHIB is underway. Watchstander needs to remember to check for incoming messages at Station.

Real-time vessel locations

How valuable was the ability to have a real-time location on these units?

- Cite examples, time savings? money savings? Performance enhancements?

Did you make use of the position reporting capability? (If no, why not, if yes, was it beneficial?)

Yes. With this, didn't have to call to find out where the boat is.

Did the position reports save you time? (list and describe)

Did the position reporting improve efficiency of operations or improve performance? (list and describe)

Yes. Didn't have to do OPS and Position Reports every hour on the radio or cell phone. Also, sometimes do not have charts of area onboard but with this can call back to check location.

Protected Communications

How valuable was the ability to protected communications to these units?

- Cite examples, time savings? money savings? Performance enhancements?

Since BOATRACS provides a more protected communications path than cellular, was this capability important or useful? (list and describe)

Very helpful. The RHIB is a non-standard boat so has no secure communications capability. With this system, the Press and other boaters cannot scan and listen to conversations (like on VHF and cellular).

Ease of use

How easy was the system to use?

- How much training was required? How long did it take to become proficient in using?

Were you able to use the system successfully?

Yes.

Did you receive sufficient training in the use? How much training time is required?

Yes.

Efficiency improvements

Was there any improvement to operational efficiency?

- Manpower savings? Time savings?

Any improvements to operational efficiency or performance not already discussed? (list and describe)

General Comments

Any general comments/remarks not already discussed?

CWO Holten comments: system good. There are many places in the AOR where there is no VHF or cellular coverage.

There is no highsite at Group that Station NOLA has access to.

There are many problems with cell phones when roaming; also many fringe coverage areas. BOATRACS can reduce the long distance cell phone calls and also the expensive roaming charges.

75% of the time, use the RHIB vice the 41ft UTB. Always choose the one RHIB with BOATRACS. Know the message is always going to get through.

Some boardings need backup people, BOATRACS gives crews confidence that a message could get to the station.

Most common praise of system is that it is reliable. No matter where the vessel is they have communications (and know they will have communications!).

C-4 Group New Orleans User Feedback Forms

BOATRACS TEST EVALUATION GUIDE

Unit: Group New Orleans Communications Center

Personnel Using System: TC1, TC2, and TC3

System Technical Performance

Availability

Is the system always operational?

- In trouble log, document any difficulties in sending messages.

Any times the system was inoperable? (list and describe)

Once, system crashed and had to reload QTRACS s/w. (Operator error?, have never had this problem in lab).

Any times the BOATRACS was the only method of communication? (list and describe)

Yes. Frequently have HF problems. Many areas where there are poor communications.

Are all messages rcvd?

- In trouble log document any time unable to send message. On shore side track if messages sent not received by mobile.

Any times you were unable to send/receive messages? (list and describe)

No. messages always got through. Some cases of operator error (sending messages to wrong unit) but no problems with system.

Did the system perform in all weather conditions?

- In trouble log document any instances of failure due to poor wx.

Any times the weather prevented the system from working? (list and describe)

N/A.

Reliability

Did the system ever fail?

- In trouble log track all equipment failures, and time to repair.

Any equipment failures, if so how long to get fixed? (list and describe)

As mentioned above.

System Operational Performance

Data communications

How valuable was the ability to have data communications with these assets.

- Cite examples, time savings? money savings? Performance enhancements?

Was the data capability useful? (If no, why not. If yes, why?)

Yes. Use BOATRACS most of time for units that have it.

Any examples of how data communications improved efficiency or performance? (list and describe)

Boarding reports. Reduce time spent. Eliminate errors. Also for Epic checks (names/dates).

Did the data communications capability save any time/make your job easier? (list and describe)

Yes.

Real-time vessel locations

How valuable was the ability to have a real-time location on these units?

- Cite examples, time savings? money savings? Performance enhancements?

Did you make use of the position reporting capability? (If no, why not, if yes, was it beneficial?)

Yes, like it.

Did the position reports save you time? (list and describe)

Yes

Did the position reporting improve efficiency of operations or improve performance? (list and describe)

Protected Communications

How valuable was the ability to protected communications to these units?

- Cite examples, time savings? money savings? Performance enhancements?

Since BOATRACS provides a more protected communications path than cellular, was this capability important or useful? (list and describe)

TCC still has concerns over security of system.

Ease of use

How easy was the system to use?

- How much training was required? How long did it take to become proficient in using?

Were you able to use the system successfully?

Yes.

Did you receive sufficient training in the use? How much training time is required?

Yes.

Efficiency improvements

Was there any improvement to operational efficiency?

- Manpower savings? Time savings?

Any improvements to operational efficiency or performance not already discussed? (list and describe)

General Comments

Any general comments/remarks not already discussed?

Works great. Will miss it when it is gone.

C-5 Point Sal User Feedback Forms

BOATRACS TEST EVALUATION GUIDE

Unit: USCGC POINT SAL

Personnel Using System: CO and BM1

System Technical Performance

Availability

Is the system always operational?

- In trouble log, document any difficulties in sending messages.

Any times the system was inoperable? (list and describe)

Intermittently lose signal during rain and when rocking (both at same time). When operating off Texas and points South, would sometimes lose signal when rocking (higher angle to satellite).

Any times the BOATRACS was the only method of communication? (list and describe)

Yes. Many times BOATRACS is the only method of communications. In the Western AOR especially. Also in Freshwater Bayou. On 6 Jan off Freeport Texas, heading East, in fog and heavy seas, no communications except BOATRACS.

Are all messages rcvd?

- In trouble log document any time unable to send message. On shore side track if messages sent not received by mobile.

Any times you were unable to send/receive messages? (list and describe)

No. all sent/rcvd ok. No problems.

Did the system perform in all weather conditions?

- In trouble log document any instances of failure due to poor wx.

Any times the weather prevented the system from working? (list and describe)

When combination of heavy seas and rain, intermittent signal loss experienced. Not enough to shut down communications link though.

Reliability

Did the system ever fail?

- In trouble log track all equipment failures, and time to repair.

Any equipment failures, if so how long to get fixed? (list and describe)

No problems.

System Operational Performance

Data communications

How valuable was the ability to have data communications with these assets.

- Cite examples, time savings? money savings? Performance enhancements?

Was the data capability useful? (If no, why not. If yes, why?)

Tried running operation with Station Grand Isle, using system for EPIC checks. Station has problems with phone lines (for QTRACS dial-up) so typically 20min delay in messages. Other times with Group, worked well.
Send evening boarding reports.

Any examples of how data communications improved efficiency or performance? (list and describe)

Nice to have data capability. Speeds up some things and reduces frustration (over reading text over voice VHF or HF circuit).

Did the data communications capability save any time/make your job easier? (list and describe)

For the most part was user-friendly. Screen was sometimes difficult to see in daytime. As mentioned above, the new location of keyboard was not as convenient. Something smaller would be better.

Real-time vessel locations

How valuable was the ability to have a real-time location on these units?

- Cite examples, time savings? money savings? Performance enhancements?

Did you make use of the position reporting capability? (If no, why not, if yes, was it beneficial?)

Tried to. Group OOD's still asking for position though [lack of knowledge/training].

Did the position reports save you time? (list and describe)

Did the position reporting improve efficiency of operations or improve performance? (list and describe)

Protected Communications

How valuable was the ability to protected communications to these units?

- Cite examples, time savings? money savings? Performance enhancements?

Since BOATRACS provides a more protected communications path than cellular, was this capability important or useful? (list and describe)

Depends on the format. Send some stuff on BOATRACS, some on voice circuit. Almost always have secure voice (either VHF or HF). HF usually available.

Ease of use

How easy was the system to use?

- How much training was required? How long did it take to become proficient in using?

Were you able to use the system successfully?

Yes. Pretty simple.

Did you receive sufficient training in the use? How much training time is required?

Yes.

Efficiency improvements

Was there any improvement to operational efficiency?

- Manpower savings? Time savings?

Any improvements to operational efficiency or performance not already discussed? (list and describe)

General Comments

Any general comments/remarks not already discussed?

Like the system. Cuts through some of the problems with voice. Send large amounts of information. Can organize thoughts as you type and then send. Used successfully for a termination case.

Laptop was easier to use than keyboard. Could manipulate the messages better. Readability at night was a problem [since resolved, operator error]. In the daytime, OK except in certain sun conditions when it is difficult to see. Glare shield didn't help so didn't use. Software needs a message light and tome to indicate new messages. Directories and histories were useful. Could delete what you didn't want to save.

Routinely used system for Moored and Underway messages.

Operational procedures not set so could not use it for all it could do.

E-mail capability wasn't that useful. Don't usually need to send messages to anyone other than the Group. Also wasn't sure if OOD would check e-mail [Group not on SWSIII yet]. Rarely work for District and rarely need to talk directly to them.

Group had long dial-up interval set so sometime had to call Group and tell them to check messages. Also, Group would sometimes ask for position instead of just looking on the system.

In the Western AOR, typically have no communications (VHF or HF) except BOATRACS.